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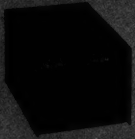

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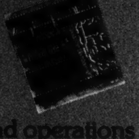

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Basically, this new Cromemco Model SDI* is a two-board interface that plugs into any Cromemco computer.

The SDI then maps computer display memory content onto a convenient color monitor to give high-quality, high-resolution displays (756 H x 482 V pixels).

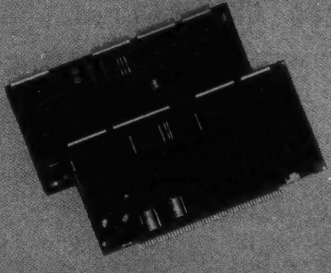
When we say the SDI results in a high-quality professional display, we mean **you can't get higher resolution than this system offers in an** NTSC-conforming display.

The resolution surpasses that of a color TV picture.

BASIC/FORTRAN programming

Besides its high resolution and low price, the new SDI lets you control with optional Cromemco software packages that use simple BASIC- and FORTRAN-like commands.

Pick any of 16 colors (from a 4096-color palette) with instructions like DEFCLR (c, R, G, B). Or obtain a circle of specified size, location, and color with XCIRC (x, y, r, c).



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HIGH RESOLUTION

The SDI's high resolution gives a professional-quality display that strictly meets NTSC requirements. You get 756 pixels on every visible line of the NTSC standard display of 482 image lines. Vertical line spacing is ½ pixel.

To achieve the high-quality display, a separate output signal is produced for each of the three component colors (red, green, blue). This yields a sharper image than is possible using an NTSC-composite video signal and color TV set. Full image quality is readily realized with our high-quality RGB Monitor or any conventional red/green/blue monitor common in TV work.

Model SDI plugs into Z-2H 11-megabyte hard disk computer or any Cromemco computer

DISPLAY MEMORY

Along with the SDI we also offer an optional fast and novel **two-port** memory that gives independent high-speed access to the computer memory. The two-port memory stores one full display, permitting fast computer operation even during display.

CONTACT YOUR REP NOW

The Model SDI has been used in scientific work, engineering, business, TV, color graphics, and other areas. It's a good example of how Cromemco keeps computers in the field up to date, since it turns any Cromemco computer into an up-to-date color display computer.

The SDI has still more features that you should be informed about. So contact your Cromemco representative now and see all that the SDI will do for you.

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Growing Up helps families cope with the teenage years. Teenagers learn more about their physical and emotional changes, and parents learn more about helping their children through it all.

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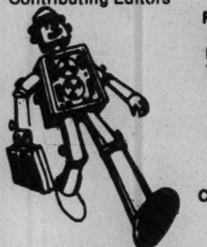

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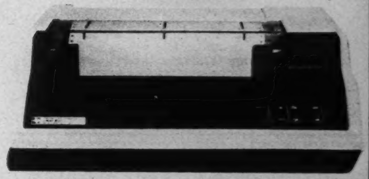

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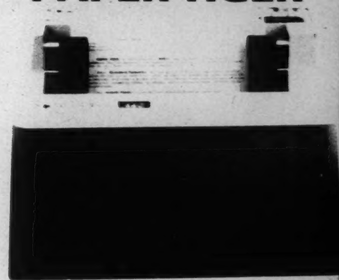

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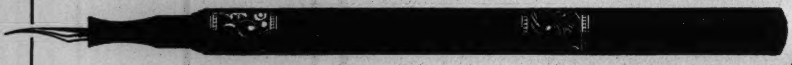

Input/ Output

Old Fashioned Service!

Dear Editor:

I firmly believe that *Support* will turn out to be the "name of the game" in microcomputers and peripherals. With so many products on the market it is hard for a purchaser to tell in advance what will happen when an expensive piece of equipment needs service. I read "On Buying Printers and Other Fun" in the June, 1980 issue and it greatly contributed to the queasy feeling I got when the printhead of my printer was damaged in a recent accident. The good news is the prompt response I got from the manufacturer, Anadex.

My printhead was damaged on a Saturday morning. Since I did not relish the thought of packing up a heavy printer and shipping it back to the company, I immediately wrote a letter asking if it would be possible for me to replace the printhead myself. Early Monday morning I received a phone call from Mr. Mike Murphy of Anadex who gave me instructions on how to remove the printhead and send it back for a reconditioned replacement. I packed up the printhead, enclosing my check for $40, and sent it by first class mail to Anadex. The postal clerk assured me it would arrive the next day! When I had not heard from Anadex by the next Monday, I called them to find that the printhead had not arrived. The next morning, Anadex called to report that the printhead had still not been received, but they were willing to send me a replacement C.O.D. (hoping that the one I returned would eventually appear). As it turns out, my printhead was received later that day (Tuesday). On Thursday morning, I received the new printhead and my printer is up and running again.

I bought my Anadex printer because I liked the quality of the print. The 9 x7 dot matrix produces clean crisp listings which can be used for reproduction. It was nice to discover that the printer is backed up by old-fashioned service. The people at Anadex went out of their way to give prompt service. (I can't say the same for the U.S. Post Office!) The company seems to understand those of us who have become addicted to our printers and suffer withdrawal symptoms when they are down. They really have made my day . . . and the least I can do is pass the word on.

John J. Wavrik
Satisfied Anadex Customer
545 Ford Avenue
Solana Beach, CA 92075

We get a lot of letters complaining about vendor treatment, but for obvious reasons — like verification — have to go easy on printing them. So it's really nice to get a Class A Happy Customer tale. —*ED*

Serial vs. Parallel Interface

Dear Editor:

There are whispers around that someone is about to hit the market with a cassette recorder for under $250 that has 8 track Parallel input. I assume that this means that it is much like a tape reader, only Much, Much faster. Best of all it will offer approximately 8 times the storage capacity, per tape, as a standard cassette recorder.

It seems to me that the electronics for parallel I/O is a lot simpler than serial I/O, and therefore cheaper to build. But who makes a cheap 8 track head? Do any of your readers know who is about to put this recorder on the market? If so, would they share this information with me?

S. B. Wahlberg
P.O. Box 502
Silverado, CA 92676

There are currently cassette recorders on the market that work with eight track parallel I/O that can interface with the eight bit I/O ports of a microprocessor. These devices are quite a bit faster than other cassette recorders employing serial I/O circuitry. None of the manufacturers that I have spoken to recently know of any device on the market in the $250 range, however. Most cassette recorders supporting parallel I/O cost about three to five times as much. Perhaps someone reading this knows of parallel cassette recorders in this price range.

In most cases a parallel interface circuit is more straightforward to design than a serial circuit because of the way information is handled in the microprocessor. Most common microprocessors represent information in the format of eight-bit bytes coming off the external data bus. In order to send this information over one or two wires as a serial transmission, each byte must first go through a conversion process which receives the information one byte at a time and sends it out one bit at a time. However, for every eight-bit byte coming in, eight bits do not come back out. There will always be more bits coming out of the serial transmitter because extra bits are needed to define the beginning and end of each byte, as well as the beginning and end of each transmission. This makes data transmission slower. Serial transmission also requires a parallel-to-serial converter at the sending end, and a serial-to-parallel converter at the receiving end. These devices are commonly implemented in three or four chip circuits.

The advantages of serial communication are cost and ease of installation. For every parallel line to a printer or keyboard there are usually at least nine wires, sometimes as many as thirty-four to fifty wires in a ribbon cable. This cable is quite expensive, and it is usually much cheaper to implement a serial data line. If the computer system is to be used in an office environment it would be very difficult to have ribbons of cable stretching all over, whereas a few serial lines can be hidden under a strap on the floor or ceiling. —*David A. Gewirtz*

Atari Speaks Out

Dear Editor:

We enjoyed Ted Nelson's article in the June issue, as well as the "Outpost: Atari" column. However, for your own information (and Ted's): Atari is working on providing as complete documentation for its personal computer systems as possible. It is *not* our intent to keep information on our system "secret" from the general public, and we *are* providing preliminary documentation for those commercial software developers who have a serious need for it. We just don't want to release manuals and documentation to the general public which haven't been thoroughly reviewed and refined here first. (Consider what it would be like if we had to handle 100 calls a day asking "How do I program my own "Star Raiders™" game?")

Ted M. Kahn
Education Consultant
Personal Computers
Atari
1265 Borregas Avenue
Sunnyvale, CA 94086

Dear Editor:

I read with great interest, and some amusement, Ted Nelson's recent review of The Atari Machine in your June issue. I appreciated his incisive analysis of the graphics capability of the Atari 800 Personal Computer and the Star Raiders™ cartridge. While his analysis of a variety of Machiavellian schemes on Atari's part to withhold information dealing with the custom graphics chips in the machine were amusing, I feel I owe it to your readers, and to current and future owners of Atari Personal Computer Systems, to clarify our position with regard to the release of technical information.

It is Atari's intention to provide a technical reference manual for retail sale by the Fourth Quarter of 1980. This manual will document all of the features of both the Atari 400 and Atari 800 Personal Computer Systems, including custom chips which, among other things, allow for the exceptional color graphics and sound capabilities of the Atari Personal Computers.

We are proud of the power and sophistication that have been designed into the custom circuitry of Atari Personal Computers, and we wish to make the full power of the machine available to any interested individuals. However, to get this documentation in readable form has required a considerable amount of editing and testing prior to its release for publication. It is for this reason that, up to now, we have not permitted independent software developers to disclose technical details of the Atari Personal Computer until we have had an opportunity to test and verify the accuracy of the documentation. It has been a long standing policy of ours to encourage independent software developers to produce high quality software for the Atari Personal Computers. We will continue to do this for the foreseeable future, and I encourage you and your readers to look for our new technical reference manual toward the end of 1980.

Peter N. Rosenthal
Director of Marketing
Personal Computer Systems
Atari
1265 Borregas Avenue
Sunnyvale, CA 94086

* * *

Dear Humans, Start At Line 10

```
5 REM  If you are a human, start at line 10, else
7 GOTO 290
10 DEAR CC,
20 :
30 :     MANY READERS OF CC SEEM TO BE CONSCIOUS OF THE SHORT-
40 COMINGS OF BASIC IN THE AREA OF CONTROL STRUCTURES APPROPRI-
50 ATE TO THE PRACTICE OF STRUCTURED PROGRAMMING.  ONE SMALL
60 BUT ANNOYING PROBLEM IS THE ELIMINATION OF LEADING BLANKS BY
70 THE POPULAR MICROSOFT BASIC, WHEN A PROGRAM LINE IS INPUT BY
80 THE PROGRAMMER.  ONE WAY TO AVOID THIS COLLAPSING OF YOUR
90 LOVELY INDENTATION IS TO BEGIN AN INDENTED LINE WITH A ":".
100 :
110 :     SINCE BASIC RECOGNIZES THE COLON AS A SIGNIFICANT,
120 THOUGH NULL LINE, THE FOLLOWING SPACES ARE NOT SUPPRESSED.
130 THE VERY SMALL ADDITIONAL TIME REQUIRED TO PROCESS THE
140 NULL LINES AND BLANK CHARACTERS MAY WELL BE AN ACCEPTABLE PA
Y-
150 MENT FOR THE INCREASE IN READABILITY.
160 :
170 :     SINCE THIS LETTER IS WRITTEN ON AN EXIDY SORCERER, THE
180 SUGGESTED TECHNIQUE CLEARLY WORKS IN AT LEAST ONE ENVIRON-
190 MENT!  THERE IS NO REASON I CAN THINK OF WHY IT SHOULD'NT
200 PAN OUT ON TRS-80'S, PET'S AND APPLE'S, TOO.  BY THE WAY,
210 YOU NOTICE IT IS A GOOD WAY TO PRODUCE (NEARLY) BLANK
220 LINES IN A PROGRAM LISTING.
230 :
240 :     THE FOLLOWING SHORT PROGRAM ILLUSTRATES THE METHOD:
250 :
260 :
290 PRINT CHR$(27);CHR$(17):REM  INITIALIZE PRINTER
300 FOR I= 1 TO 5
310 :    FOR J= 0 TO 4
320 :        PRINT I+J;
330 :    NEXT J
340 :    PRINT
350 NEXT I
READY
RUN

 1  2  3  4  5
 2  3  4  5  6
 3  4  5  6  7
 4  5  6  7  8
 5  6  7  8  9
READY
```

Ben Cushing
1928 Julie Avenue
Fullerton, CA 92633

P.S. A disadvantage is that lower case letters are apparently converted to upper case in a non-REM program line — I wrote the letter using lower case.

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for small computers
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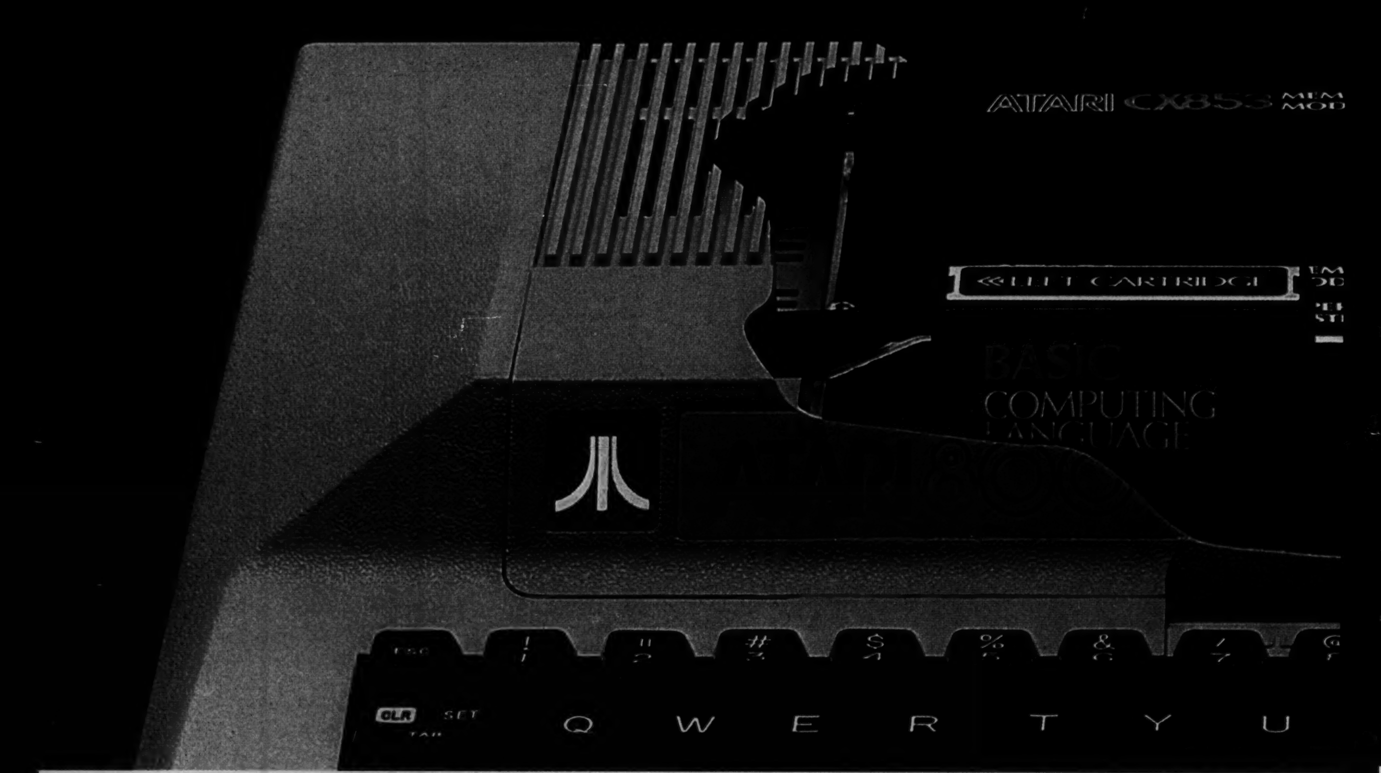

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CIRCLE 107 ON READER SERVICE CARD

After you've broken the

I/O, cont'd...

The Guiding Guide

Dear Editor:

I read your Author's Guide carefully and found it so useful I am using it for other writing projects unrelated to computers. Incidentally, I am one of the "jaded professionals" you refer to and found your outlook on computers to be very refreshing indeed.

Robert M. Bennett
SR 1418
Chugiak, AK 99567

Thanks. —Ed.

Waiting for Atari

Dear Editor:

Your June issue was most entertaining. I especially found the articles dealing with the use of polar coordinates to be of immense value. I have just purchased an Atari 800 and converted a program to plot functions, as follows. As I have yet to receive the Basic reference manual, my only source of information was the Basic self-teaching guide. Thus many enhancements will be possible as more Atari information becomes available.

```
10 REM ******************************
20 REM * GRAPHING POLAR FUNCTIONS *
30 REM ******************************
90 DIM A$(1)
100 W=0
110 PRINT"[CLR]"
120 PRINT"STEP"
130 INPUT A
140 PRINT "SCALE"
150 INPUT S
160 PRINT"DO YOU WANT TO SEE"
170 PRINT"THE X-Y AXES (Y/N)"
180 INPUT A$
190 IF A$="Y" THEN W=1
200 GRAPHICS 7
210 COLOR 1
220 IF W  1 THEN 280
230 SETCOLOR 0,11,10
240 PLOT 0,40
250 DRAWTO 157,40
260 PLOT 79,0
270 DRAWTO 79,79
280 SETCOLOR 1,14,10
290 FOR I=0 TO 360 STEP A
300 T=I/57.3
310 Y=COS(4*T)*SIN(T)
320 X=COS(4*T)*COS(T)
330 Y=INT(Y*S):X=INT(X*S)
340 IF I=0 THEN PLOT 79+X,40-Y
350 DRAWTO 79=X,40-Y
360 NEXT I
370 END
```

Notes

Line 110 — to clear screen type PRINT", hit the escape key, press shift, hit clear key, and type "

Line 310 — enter the function you want to plot (say, COS(4*T))

Line 320 — follow same procedure

Gary Douchant
11 Kensington Hts Dr. Apt-E
Belleville, IL 62223

More On PET Printer

Dear Editor,

In reference to the article by Larry Watkins in the May issue of *Creative* about the Commodore 2022 Tractor Feed Printer:

I don't know if Mr. Watkins' printer is different, but I don't have to open mine at all to insert paper — the tractor assembly tilts forward, the paper is fed in behind the tractors and it comes up in the front. Move the tractors back and secure the paper. That's all!

Two other problems that were not mentioned in the article have since been cured by a ROM upgrade. The first is the way the printer skipped lines. Now, instead of actually "printing" a whole blank line, the paper just advances one line. (This really speeds up doing a form feed!) The second problem was not being able to list programs in upper and lower case instead of upper case and graphics. The solution here is a newly implemented secondary device address that, when ordered, shifts the 2022 to lower case mode before listing a program. The upgrade ROM is available FREE from Commodore to anyone whose printer was built before the end of 1979. More details are in the ninth issue of the PET Users Club Newsletter.

Otherwise my experience with the 2022 has been about the same as Mr. Watkins': The 2022 is rugged, reasonably fast, noisy as sin and it's been working fine since I took it out of the box in December. One more thing — the $995 price tag is now down to $795. Oh, well!

Steve Leth
L-8 Jamestown Square
Blackwood, NJ 08012

Watch Those Typos, Folks!

Dear Editor:

I have received many letters saying there are bugs in Bill Smith's "Grandapple Clock" (Jan '80 p. 104), and have spent many hours finding typing errors in people's listings (usually the data statements have a number or two added, missing, or incorrect).

If typed as it appeared in *Creative Computing*, the program works. The code may be imperfect, but it works.

Although most people asked me to do syntax checks, some people did write to say they enjoyed Mr. Smith's first program. I was particularly impressed with two writers: Larry Fitzpatrick and John McKillan. These two gentlemen obviously took the time to read what was being typed and came up with reasonable suggestions for improvement. These changes follow.

A lot of the stylistic weaknesses have been improved by Gary Little (president of "Apples British Columbia," #101-2044 West Third Ave., Vancouver, B.C., V6J 1L5).

In conclusion, I would like to thank those who took the time to type in the program and even improve it. As for those who swore there were bugs (probably put in on purpose as Wine Yellow would say), I can only note that Microsoft has a fine typing tutor . . .

Larry Fitzpatrick's changes: 1629 Elizabeth Street, Melbourne, FL 32901:

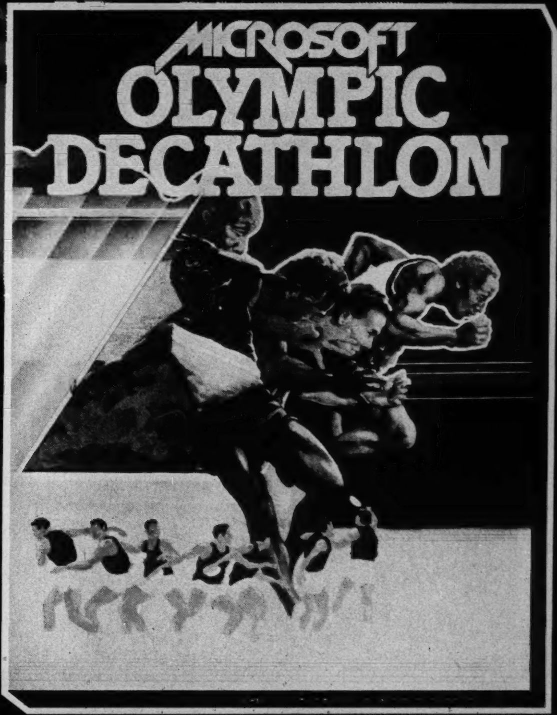
a. omit line 119
b. change line 286 to read: 286 Flag=0:IF R=0 Then GOTO 90

John McKillan's changes: 817 Lavonne Dr., Santa Monica, CA 93454:

a. In Line 695, replace XPM% with OPM%
b. Change line 795 to read: 795 Goto 600
c. The alarm will not go off if "SET" in line 735 is greater than 1200. To fix this problem:
    1. Change line 736 to 737, i.e., delete 736, add: 737 Goto 770
    2. Add: 736 IF Set ≥ 1200 then Set = Set − 1200

Christopher Howerton
13572 92 Avenue
Surrey, B.C.
Canada V3V 1H7

After you've broken the pole vault record, see if you can outsmart the killer dwarves.



Two incredible games from Microsoft.

There are plenty of computer games around. But most of them probably won't hold your interest for more than a few hours.

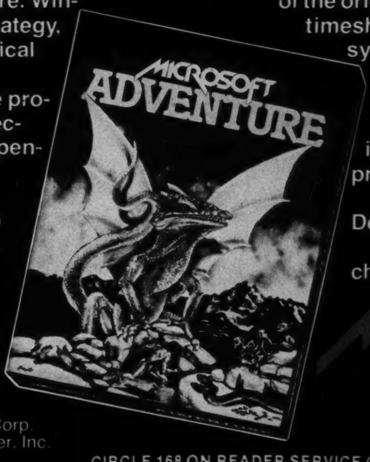
That's what makes these two releases from Microsoft so remarkable. They'll keep challenging you in new ways every time you play.

Olympic Decathlon — a real workout!

There's never been a program that tests your reflexes and coordination like Olympic Decathlon. Just like the real one, Microsoft's has 10 events, including shot put, pole vault, long jump, javelin throw, and six more. Winning takes a combination of strategy, timing, coordination, and physical endurance (really!).

When you jump or throw, the program calculates the actual trajectory, and shows you what's happening with exciting animated graphics. After each event, the scores of all competitors (up to 8) are displayed. It's the ultimate party game to show off your computer!

Disk-based Decathlon runs on a 32k TRS-80. The cassette version requires a 16k Level I or Level II system.



Versions for the Apple II available soon.

Adventure — the classic mind game.

If you've ever been lucky enough to play Adventure on a big computer, you know how addictive it is. Fantasy, deduction, and magic all come into play as you explore the chambers of Colossal Cave, collecting treasure while avoiding pitfalls and hostile creatures. There are surprises around every corner, and even veteran players keep discovering new things and improving their scores.

Microsoft has the complete microcomputer version of the original FORTRAN Adventure that runs on large timesharing systems. It runs on TRS-80 and Apple II systems with at least 32k memory and one disk.

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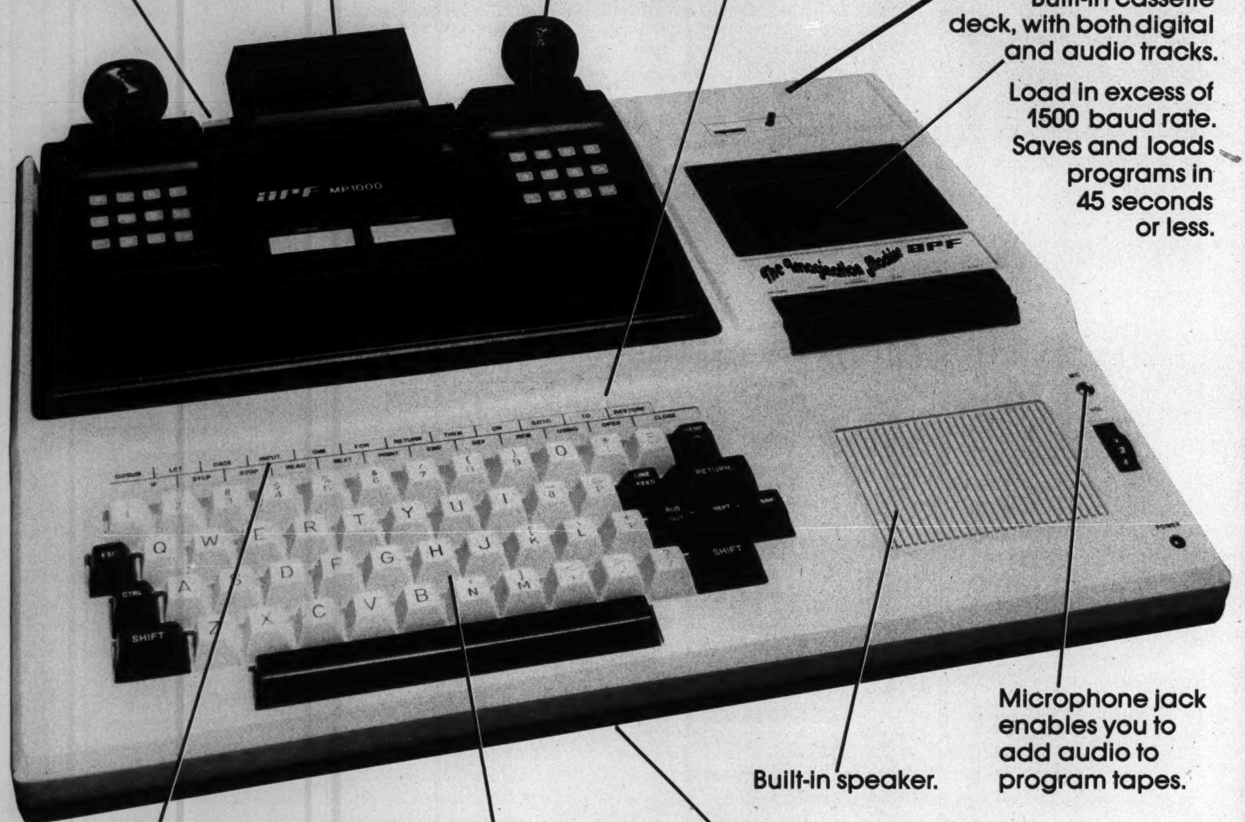

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For example, it stores programs and data on the same cassette tape. (With other computers, you have to read programs from one tape into the computer, remove the tape, put in another tape and store your data on the new tape.)

Another special feature is The Imagination Machine's unique keyword system, which simplifies BASIC programming. The machine has 24 different programs statements and commands printed at the top of the keyboard. You can enter these 24 into your program without retyping them every time you use them. Instead of typing out "PRINT," for example, you just press two keys and the word appears on the screen. The system helps prevent typing errors and can speed up entering programs.

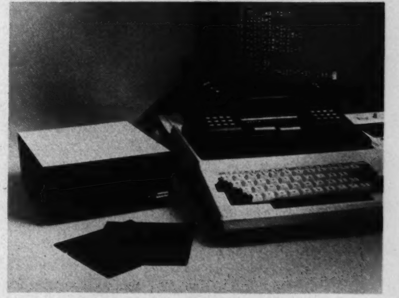
A third feature is Timed Response Monitoring, which automatically adjusts the computer's pace and level to your own. It makes "tutoring programs," for instance, easier and more interesting to follow.

And then there are The Imagination Machine's three graphic display modes: 1. Alpha numerics, mixed with low-resolution graphics in as many as eight colors. 2. High resolution — up to eight colors — 128 x 192 display. 3. High resolution graphics — up to four colors — with 256 x 192 display.

And expandability.

A personal computer that can't grow along with your growing requirements soon becomes obsolete. So, we designed The Imagination Machine to be expandable. By adding APF's optional "Expansion Box" and interface cartridges, you can hook up any compatible floppy disk or printer, or an additional 8K RAM memory cartridge.

Full mini-floppy system $995.



For small business and professional use, you may require a full mini-floppy system. In that case, order APF's System II. It includes The Imagination Machine, the "Expansion Box," floppy disk interface and 72K-byte, mini-floppy disk drive. All for just $995! No one can come close to that price.

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If you can find a better personal computer system for the money, let us know. In the meantime, we stand by our statement: There is no other personal computer on the market that offers so much for so little. And if you order now, we'll even include our $19.95 APF Technical Reference Manual, with complete schematics, absolutely free.

Order The Imagination Machine directly from APF Electronics, with the assurance that if you are not completely satisfied, you can return it within 30 days of purchase for a complete refund. To order, or to learn the name of the dealer nearest you, call TOLL FREE 1-800-223-1264. New York residents call 212-869-1960. MasterCard and VISA accepted.

Price list:

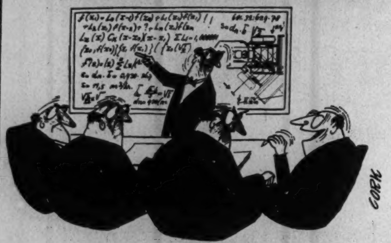
System I, The Imagination Machine.	**$599.**
System II, Mini-floppy System (Includes The Imagination Machine, BB-2, and Mini-floppy Disk Drive).	**$995.**
BB-1. Expansion Box with RS232 cartridge.	**$199.95**
BB-2. Expansion Box with floppy disk interface cartridge.	**$199.95**
8K RAM memory cartridge.	**$ 99.95**
RS232 cartridge.	**$ 99.95**
Floppy-disk interface cartridge.	**$149.95**
Mini-floppy Disk Drive.	**$399.95**

$599. Manufacturer's suggested retail price.

apf electronics inc.
1501 Broadway New York, NY 10036

CIRCLE 241 ON READER SERVICE CARD

et cetera et cetera et cetera



Mid-Atlantic Computer Shows

The Mid-Atlantic Computer Show will be held at the D.C. Armory/Starplex, Washington, D.C., September 18-21, 1980. Show hours are: Thursday-Saturday, 11 A.M. to 9 P.M., Sunday 11 A.M. to 6 P.M. General adult admission $5. An end-user public exposition featuring small and medium-sized business systems, scientific, engineering computers, and micro-computers. Produced by National Computer Shows, 824 Boylston Street, Chestnut Hill, MA 02167. Tel: (617) 739-2000.

Mid-West Computer Show

The Mid-West Business & Home Computer Show will be held at McCormick Place, Chicago, IL, October 16-19, 1980. Show hours are: Thursday-Saturday, 11 A.M. to 9 P.M., Sunday 11 A.M. to 6 P.M. General adult admission $5. An end-user public exposition featuring small and medium-sized business systems, scientific and engineering computers, micro-computers and electro-technology, produced by National Computer Shows, P.O. Box 678, Brookline, MA 02147. Tel: (617) 524-4547.

APL Conference

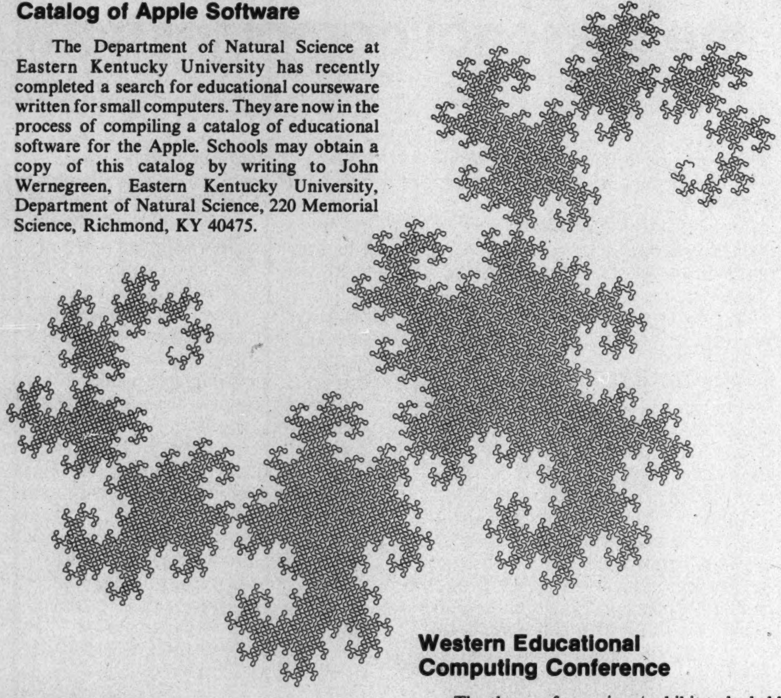
An APL User's Meeting will be held October 6-8 at the Hotel Toronto, Toronto, Canada. Registration fee is $180. Canadian, $155. U.S. For further information contact: Rosanne Wild, Conference Coordinator, I.P. Sharp Associates Limited, 145 King Street West, Toronto, Ontario, Canada M5H 1J8. Phone: (416) 364-5361.

Correction

In "The Electric Company" (July '80) on Page 99, Line 540, the end of the line should read: RT=R.

Catalog of Apple Software

The Department of Natural Science at Eastern Kentucky University has recently completed a search for educational courseware written for small computers. They are now in the process of compiling a catalog of educational software for the Apple. Schools may obtain a copy of this catalog by writing to John Wernegreen, Eastern Kentucky University, Department of Natural Science, 220 Memorial Science, Richmond, KY 40475.



Assistance for Teachers of Programming

A new newsletter, "Teaching Computer Programming," is available for teachers' use in programming courses. The first issue is yours upon request. The subscription rate is $8. for 12 issues. Contact Craig Nansen, 1112 Glacial Drive, Minot, ND 58701.

Political Support For Computers

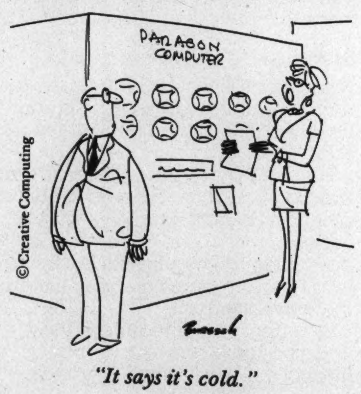
A bill concerning computers and education, H.R. 7549, has been introduced into the House of Representatives. This amendment to Title III of the Elementary and Secondary Education Act of 1965 asks for the establishment of one or more National Centers for Personal Computers in Education. Among other functions, these centers would: develop courseware materials for use in areas where available courseware materials are inadequate, develop methods for enabling handicapped individuals to use computers for communication and educational purposes, and establish a demonstration laboratory to exhibit examples of personal computer systems and courseware materials to enable educators to personally observe the operation of such computers and courseware materials.

You can support this bill by writing to your representative and encouraging others to do so.

Western Educational Computing Conference

The theme of a seminar/exhibit to be held November 20-21 in San Diego, CA, is "Educational Computing in the '80's" and will feature papers and seminars on the use of computing in higher education for instruction, administration, and research. Luncheon speakers will be Capt. Grace Hopper, USN, and Bernard Luscombe, President, Coastline College.

For further information contact Ron Langley, Director, Computer Center, California State University, Long Beach, 1250 Bellflower Boulevard, Long Beach, CA 90840. Phone (213) 498-5459.



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CP-190

CIRCLE 148

Random Ramblings

David H. Ahl

The Consumer Electronics Show

Overall view of CES on June 15, 1980 opening day.

Faithful readers of this column will recall that last year (1979) the summer CES (Consumer Electronics Show) overlapped NCC (National Computer Conference). Consequently we were somewhat rushed in covering the CES because we had to rush back from Chicago to New York to get to the opening of the Personal Computer Festival part of NCC. This year the conflict didn't exist so we decided to splurge a bit and stay in the more posh Ascot Hotel in Chicago which was one step above the Avenue Motel (the absolute pits).

At best we were not at all pleased to learn when we arrived at the Ascot, on Saturday night June 14, that our reservation had been botched up and there were no rooms to be had. However, the desk clerk at the Ascot phoned the Avenue and indeed found that there were several rooms, as well there might be. The beds were lumps of Play Doh molded into something that resembled a mattress, but in actuality had to be taken off the bed and stacked against the wall. We wound up sleeping on the inner springs with the air conditioner putting out a minimal amount of coolish air. Noise from the street and adjacent room rivaled the loudest sound systems to be heard at CES and it was not until downing a bottle of wine and watching Burt Lancaster in "The Bird Man of Alcatraz" on the late, late show that I finally dozed off into a fitful sleep.

The following day was reminiscent of February and gave no hint that summer was just six days away. As we waited for over a half hour for a bus to transport us to the McCormick Place Convention Center we wondered whether we had made a wise decision in electing to stay three days in Chicago for the "summer" CES. However, upon arriving at the show we were overwhelmed, as usual, with the incredible hustle-bustle of visitors waiting to shove and push their way into the exhibits. What follows is just an overview of some of the many, many new products that were shown to the world for the first time at the show.

Electronic Games and Craziness

Atari announced four new home video games for their video computer system at CES: Maze Craze, Video Checkers, Dodge 'Em and a new Championship Soccer Game.

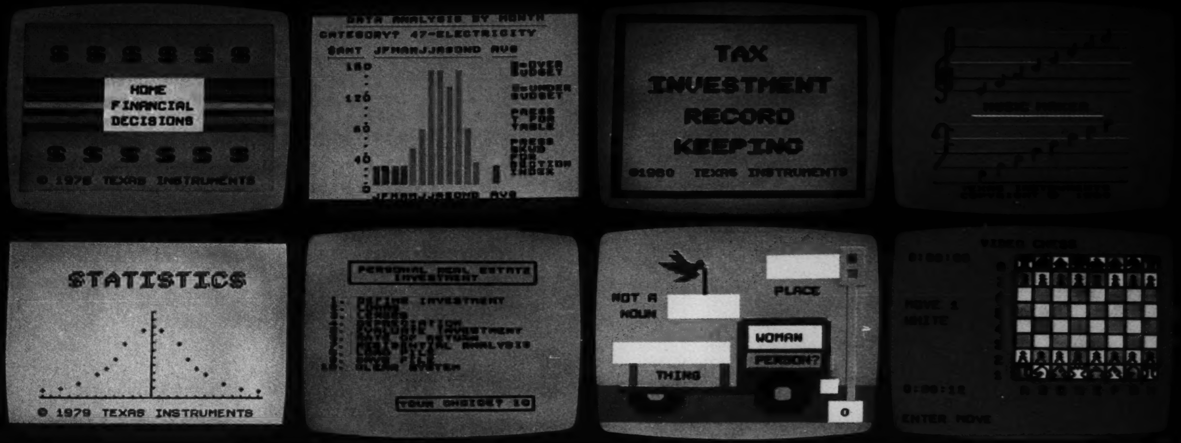
The soccer game is the first home game we've seen that features the new "scrolling" playing field. This feature gives players the impression that they are hovering above the playing area, following the ball and the teams as they travel up and down the field. The game was designed by a soccer coach for maximum realism in running, passing, shooting and team work and has 54 variations including choices of goal sizes and team speeds.

Maze Craze is a multi-faceted game that basically challenges two players to race through a maze, each chasing or avoiding "computer foes" which are also traveling through the maze. There are many variations including a version which allows one player to set up "false walls" to confuse his opponent and another version which features an invisible maze.

Dodge 'Em is a driver's game. The player/driver tries to avoid colliding with an oncoming computer car while gaining points for completing laps. However, with each successful lap the game gets harder with the addition of "smarter" and more numerous, aggressive computer cars. One or two drivers may play at a time.

Atari also announced the national Space Invaders Competition, with the

Announcing Texas Instruments Author Incentive Program... win up to $3,000.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HOME FINANCIAL DECISIONS
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CATEGORY? 47-ELECTRICITY
TAX INVESTMENT RECORD KEEPING
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ENTER MOVE

Texas Instruments is looking for unique home computer programs. If you have some, we can help you turn them into profit makers. To begin with--you could win up to $3,000. You'll still own the programs...we may help you sell them.

One of the most exciting things about the home computer revolution is discovering the many ways a computer can be used.

If you've been working with small computers for a while, chances are you've developed some innovative application programs. This is your chance to put them to work — for a profit.

Texas Instruments is looking for quality programs. We've created an Author Incentive Program to make it worth your while. The award for the top program will be $3,000. And there are five $1,000 awards, plus twenty $500 awards. All winners will be recognized with national publicity. Even if you don't receive one of these monetary awards, we may see enough market potential for your program to help you develop it and sell it.

We want programs that offer real utility and lasting value. Programs that are self-teaching, that communicate on human terms. After all, the TI Home Computer was designed to be the first home computer the whole family can use.

TI is interested in education, personal finance and technical or managerial programs for professionals. Home management programs, hobby and simulation programs. We prefer that your submissions exclude entertainment packages.

Your entry can be a program you've created for use on the TI-99/4 or other microcomputers — in any high-level language, from Pascal and BASIC to FORTRAN or COBOL — or even assembly language. All the way up to 48K RAM.

Keep in mind that programs for the TI Home Computer can incorporate high-quality color graphics, music and sound effects, and TI's remarkably-human synthesized speech.

To submit an entry, call the toll-free number below or use the reader service card in this magazine. We'll send you an entry submission form plus full details. *Please don't send anything until you receive and fill out this entry form.*

Programs must be in by November 15, 1980 — so get your entry form soon.

Fifty Years of Innovation

For an entry form, call 1-800-858-4565.

Call between 8 a.m.-4:30 p.m. CDT, Mon-Fri. In Texas call 1-800-692-4279.

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CIRCLE 245 ON READER SERVICE CARD

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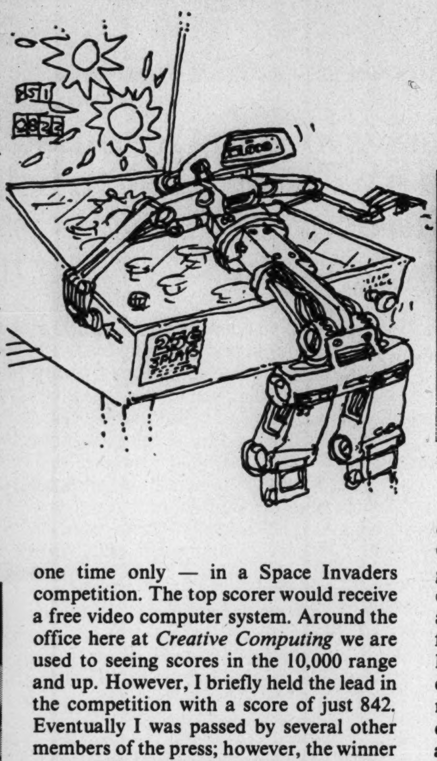
Aerial view of the upstairs part of CES.

finals being held in late fall in San Francisco, with finalists from five regional championships competing for the national crown. Space Invaders was introduced in 1978 in Japan by Taito Inc. Within one year there were over 100,000 Space Invaders coin operated games which pulled in over $600 million. The Bank of Japan had to triple its production of 100 yen pieces to meet the demand of Space Invaders players. When the coin-op game was placed in American arcades by Bally, the game's popularity was confirmed. Earlier this year, Atari purchased exclusive rights to market the home video version of Space Invaders in the US. The game immediately became the fastest selling of Atari's thirty-six games, surpassing even the perennial favorite, Break Out. As readers know, Creative Computing Software markets Space Invaders under the name "Super Invasion" for the Apple computer and it is their top seller.



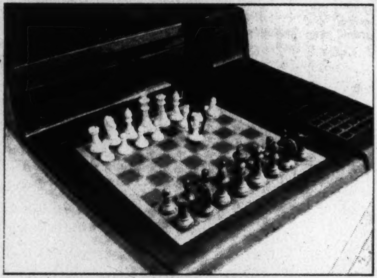
At the press reception Sunday night after Alvin Toffler's presentation, members of the press were invited to compete — one time only — in a Space Invaders competition. The top scorer would receive a free video computer system. Around the office here at *Creative Computing* we are used to seeing scores in the 10,000 range and up. However, I briefly held the lead in the competition with a score of just 842. Eventually I was passed by several other members of the press; however, the winner walked off with his video computer system scoring a measly 3240.

Atari will be sponsoring a Space Invaders competition later this fall.

Activision of Sunnyvale, California, also announced four cartridges for the Atari video computer system. Atari has sued Activision for stealing trade secrets. However, it seems likely that a settlement will be reached and that we will see cartridges from both manufacturers on dealer shelves in the fall. You will see a review of both the Atari and Activision cartridges in the October or November issue of *Creative Computing*. Keep tuned.

Chess and Backgammon Games

A spectacular introduction in this area belongs to *Applied Concepts, Inc.*, makers of the "Boris" computer chess game. A new version of Boris was introduced called the "BorisHandRoid." This automated game is complete with a robot-type arm and hand reminiscent of the three pronged Swedish sugar tongs, which extends out from the back of the unit moving pieces to the square that they are to occupy. Not only that, but the BorisHandRoid can remove his opponents' pieces when he captures them, perform the moves called for in the chess or checker game, even shake hands in congratulations at the end of the game if someone is lucky enough to beat him. This unit is obviously not for everyone at the price (which was not being quoted). However, there were several other versions of Boris which looked quite adequate for the average chess player. In addition to the "Boris 2.5 Microcomputer Chess Champion" unit, Applied Concepts also announced an electronic checkers playing set and a black jack game.



A BorisHandRoid would shake hands with you if you were able to beat it in a game of chess.

Fidelity Electronics Ltd., not to be outdone, announced "Voice Sensory Chess Challenger." Unlike other chess games on the market, this one has no display window, rather each square automatically illuminates to indicate your from-and-to moves. Also, it has no keyboard, each move is automatically entered in the "brain" unit when a piece is moved from one square to another. The display instead is a standard chess clock and it shows the time remaining for each player or tells the elapsed time of the game. In addition, it has a repertoire of 64 of the world's greatest games, including games like Morphy, Capablanca, Spassky and Fischer. You can test your own playing ability by replaying these great games and in them be either the champ or the

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- ☐ Z-80 MICROPROCESSOR PROGRAMMING & INTERFACING, BOOK 2. NO. 21610. By Nichols, Nichols & Rony. $12.95
- ☐ Z-80 MICROPROCESSOR PROGRAMMING & INTERFACING, BOOKS 1 & 2. 2-VOLUME SET. NO. 21611. $21.95

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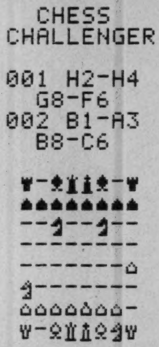
Ramblings, cont'd...

Fidelity Electronic's Voice Sensory Chess Challenger.



```
   CHESS
CHALLENGER

001 H2-H4
   G8-F6
002 B1-A3
   B8-C6
```

A portion of the printout tape from Fidelity's Chess Challenger Printer.

challenger. The voice part of the system tells you each of the moves of the unit itself and repeats all of your moves; it also calls out every capture and repeats each board position on demand. The unit, like Chess Challenger 10, has 9 levels of play plus an infinite level. The voice programming is available in English, German, French or Spanish.

Fidelity also announced a Standard Voice Chess Challenger without the sensory option, a Sensory Chess Challenger without the voice option, a check game and a bridge game. Their latest product, shown only in prototype form, was a small printer which hooked on to the Chess Challenger units which would print out a record of each move and, on demand, a representation of the entire board.

Tryon Inc., not to be outdone, announced a chess product, "Chess Traveler." This is the first battery operated chess game with a retail price under $100. It has seven levels of play, from beginner to expert, plus a problem solving mode. In addition, Tryon announced a "Chess Champion Supersystem III" which utilizes a LCD display for the chess board and an electronic printer. It, like the top-of-the-line Fidelity system, has an unlimited level of play system built-in.

Tryon, of course, is best known for its Omar Electronic Backgammon games. In addition, Tryon recently produced the "Charles Goren Bridge Master" game which can be played as partner, opponent or teacher.

Addresses of companies cited in this round-up.

Atari, 1265 Borregas Ave., Sunnyvale, CA 94086
Applied Concepts Inc., 207 North Kirby, Garland, TX 75042
Fidelity Electronics Ltd., 8800 NW 36th St., Miami, FL 33178
Tryon Inc., 23500 Mercantile Rd., Cleveland, OH 44122
Timco Engineering Inc., 12150 SW 114 Pl., Miami, FL 33176
Casio, 15 Gardner Rd., Fairfield, NJ 07006
Nixdorf Computer Personal Systems Inc., 168 Middlesex Tpk., Burlington, MA 01803
Lexicon Corp., 8355 Executive Cntr. Dr., Miami, FL 33166
Panasonic, 1 Panasonic Way, Secaucus, NJ 07094
Quasar, 9401 W Grant Ave., Franklin Park, IL 60131
Sinclar Research Ltd., 50 Staniford St., Boston, MA 02114
Ohio Scientific, 1333 Chillicothe Rd., Aurora, OH 44202
Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250
Activision Inc., 759 E Evelyn Ave., Sunnyvale, CA 94086
Hewlett Packard, 1000 NE Circle Blvd, Corvallis, OH 97330
Bally, S-W Distributors Inc., 5300 B McDermott Dr., Berkeley, IL 60163
Texas Instruments, Consumer Relations, PO Box 53, Lubbock, TX 75222
Personal Software Inc., 1330 Bordeaux Dr., Sunnyvale, CA 94086
Compucolor Corp., 5965 Peachtree Corners E, Norcross, GA 30071
APF Electronics Inc., 444 Madison Ave., NY, NY 10022
Radofin Electronics (USA) Ltd., 10B Engelhardt Ave., Avenel, NJ 07001

Language Translators

Sharp's IQ-3100 Language Translator.

Sharp introduced a new electronic translator, the IQ-3100 which is fluent in English, French, German and Spanish. Japanese language modules are available in either roman or traditional Kana characters. Each language module translates 2,000 words and 152 basic sentences which travelers use frequently. Two language modules can be snapped into the translator at one time so that one could theoretically carry on a conversation with a person from Japan and one from France at opposite sides of the table with no one speaking anybody else's language.

Timco Engineering of Hong Kong, with US offices in Miami, also introduced a new language translator with a four function calculator and metric conversion program built-in. Cartridges are available in 13 different languages, more than any other system offers at this point. In addition, a word game, bartender guide, and nutrition guide cartridges are available. Furthermore, to help you learn to speak those strange foreign words and phrases, a phonetic pronunciation capsule and display will show you the correct pronunciation of each word and phrase. (We'll be running an update of last year's review of language translators in an issue this fall. If you can wait till then you're probably better off than rushing out to buy one today.)

CAN I HELP YOU ?

Timco Language Translator.

Electronic MemoWriter

Sharp Electronics new EL-7000 MemoWriter was selected as "one of the most innovative consumer electronic products of 1980" and placed in the CES design and development exhibition. The calculator is described as "letting you put your office in your pocket" and combines the functions of a calculator with those of a miniature typewriter. It prints out mes-

9876514320
SHARP

Sharp's ELS7200 Memowriter.

PROBLEM.

INT(X^N+X*SIN(X^2),X)

SOLUTION.

muMATH
MICROSOFT

Surprised? You should be. Because until now, no software could solve anything but the most basic arithmetic problems without a series of complicated steps.

A big disadvantage? If you use a microcomputer for scientific, educational or engineering applications, you bet it is. That's why Microsoft has come up with a solution of its own. muMath.

muMath is a symbolic math package you'll recognize immediately as a major advance in microcomputer software.

muMath lets you efficiently and accurately perform the most complex mathematical operations: Exact, infinite precision rational arithmetic. Unbound variables. Complex expressions (even equations may be included). Exact solution of algebraic equations. Plus logarithmic, exponential and trigonometric simplifications and transformations.

That's right. It does in an instant what took you years to learn at school. Rational arithmetic. Algebra. Trigonometry. Transcendental functions. Symbolic differentiation (including ordinary and partial derivatives.) Symbolic integration of indefinite and definite integrals. Matrix arithmetic and algebra.

Trigonometric simplification? But of course. Just type:

```
?SIN (2*Y)*(4*COS(X)^3
-COS(3*X)+SIN(Y)*COS
(X+Y+#P1)-COS(X-Y));
```

Then instantly muMath returns:

```
@4*SIN(Y)*COS(X)*COS(Y).
```

Adding fractions? Need you ask?

```
?1/3+5/6+2/5+3/7;
@419/210.
```

muMath is written in muSIMP, which is included in the muMath package. muSIMP is an applicative, recursive language, ideal for describing complex mathematical concepts.

Because of its highly interactive nature and hierarchical structure, muMATH is an excellent math teaching device, from simple arithmetic to calculus.

muMATH is currently available for the CP/M® operating system.

The complete system, including muMATH and muSIMP on disk and documentation is $250. Runs under CP/M.

Just what you need? We thought so. Shoot some questions at us about muMATH. We have all the answers.

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CIRCLE 158 ON READER SERVICE CARD

Ramblings, cont'd...

sages, memos, bills or estimates and is "a perfect companion for businessmen, salesmen, media people, architects and engineers." The EL-7000 is a pocket size calculator with a 10-digit LCD display and 15 character per line impact printer. The typewriter has 8 memories which can hold seven letters and ten numerals or fifteen letters per memory. The printer will automatically switch over to a second memory when the previous one is full.

Things That Sing

Casio introduced the "CasioTone M-10" a new musical keyboard instrument capable of reproducing the tones of a piano, organ, flute and violin. It has a two and one-half octave range and can sound up to eight tones at one time. The M-10 has its own built-in speaker and will list for $149.95. It is kind of a kids electronic organ all grown up.

Casio model M-10 electronic keyboard instrument.

Casio also introduced the ML-90, an eight digit calculator that plays 12 melodies. You can set it to play Happy Birthday on your birthday, the Wedding March on your anniversary or Jingle Bells for Christmas. It also has a clock that shows the time down to the second, a calendar, two alarms and two date memories; in addition it has a stop watch that can be used for normal, net and lap timings. All this craziness costs only $49.95.

Very Small Computers

Nixdorf Computer

Nixdorf announced several communication peripherals to transform their LK-3000 portable, personal computer into a portable data terminal. The LK-3000 was originally introduced as a language translator, however, with the addition of a RS-232C interface and an acoustic modem the computer can now transmit at 110 or 300 bits per second over a standard telephone line. The RS-232 interface provides the capability to communicate with peripherals like printers, plotters and other microprocessors or equipment.

If you will recall when we checked out the language translation capabilities of the LK-3000 (December 1979 page 20) we were not particularly impressed. However, with the additional interface modules the LK-3000 looks like a quite capable system at a very reasonable price. The LK-3000 lists at $140, the RS-232 interface at $195 and the acoustic modem at $190. It appears to be aimed at mainly the portable terminal market and should easily replace many of the briefcase size terminals which are much more cumbersome than this unit.

The Nixdorf LK-3000 Keyboard and display unit with RS-232 module and LK-4040 acoustic modem telephone coupler.

Lexicon Corporation

In a somewhat strange move Lexicon sold marketing rights to the LK-3000 language translator to Nixdorf about a year ago. However, now this year, Lexicon turns around and announces the LEX-11 modem for use with the LK-3000 language translator. This incidentally is *not* the same modem which is being marketed by Nixdorf; it has the same capabilities but is being positioned as a modem for use with both the LK-3000 as well as any other personal or larger scale computer. The LEX-11 may be operated on batteries and has the capability to communicate with Bell System 103A models as well as other LEX-11 modems; in other words the modem may be set in either originate or answer mode.

LEX-11 Modem

Lexicon LEX-11 acoustic coupler.

Quasar and Panasonic

Quasar and Panasonic are both divisions of Matsushita Electric Corporation and so both of them have simultaneously introduced pretty much the same computer-in-a-briefcase, although the model number and logo is slightly different. Quasar terms their system the "Micro-Information System." The main unit is a hand held computer (HHC) which is intended to be compatible with other computers. It uses a 6502 microprocessor chip and a very clever bank switching technique for memory access. Using bank selection, the HHC can be configured to utilize up to 160 bits of ROM and 73K bits of RAM. In order to achieve modularity, the HHC bus structure provides extended

A growing line of tools to expand the Apple.

7440A Programmable Interrupt Timer Module. Time events in four operating modes—continuous, single shot, frequency comparison, and pulse width comparison. Includes three 16-bit interval timers, plus flexible patch area for external interface. Programmable interrupts, on-board ROM, and much more.

7720A Parallel Interface. Two bi-directional 8-bit I/O ports will connect your Apple to a variety of parallel devices, including printers, paper tape equipment, current relays, external on/off devices. Full featured, programmable interrupts, supports DMA daisy chaining.

7811B Arithmetic Processor. Interfaces with Applesoft, so you just plug in and run. Based on the AM 9511 device, provides full 16/32-bit arithmetic, floating point, trigonometric, logarithmic, exponential functions. Programmed I/O data transfer, much, much more.

7710A Asynchronous Serial Interface. Conforming to RS-232-C A thru E 1978 standard, this card will drive a variety of serial devices such as CRT terminals, printers, paper tape devices, or communicate with any standard RS-232 device, including other computers. Full hand-shaking, and fully compatible with Apple PASCAL!

7470A 3½ BCD A/D Converter. Converts a DC voltage to a BCD number for computerized monitoring and analysis. Typical inputs include DC inputs from temperature or pressure transducers. Single channel A/D, 400 ms per conversion.

7490A GPIB IEEE 488 Interface. A true implementation of the IEEE 488 standard—the standard protocol for instrumentation and test devices. Control and monitor test instruments such as digital voltmeters, plotters, function generators, or any other device using the IEEE 488.

7114A PROM Module. Permits the addition to or replacement of Apple II firmware without removing the Apple II ROMs. Available with on-board enable/disable toggle switch.

7500 A Wire Wrap Board. For prototyping your own designs.

7510A Solder Board.

7590A Extender Board.

7016A 16K Dynamic Memory Add-On.

Watch this space for new CCS products for the Apple. We've got some real surprises in the works. To find out more about the CCS product line, visit your local computer retailer. The CCS product line is available at over 250 locations nationally, including most that carry the Apple. Or circle the reader service number on this ad.

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CCS makes the difference.

We see the Apple a little differently.

We see it as a good way to get things done.

Apple has built a great computer. We at CCS have built a great line of peripherals and components to expand the Apple. To do almost anything you want to get done with a computer.

If you want to do business with an Apple, we've got tools to connect the Apple to standard business printers and terminals. Or to modems, for communications over telephone lines, with other computers, even with other Apples.

If you want to apply your Apple to engineering, scientific, or graphic projects, we've got tools for high-powered, high-speed math functions, and fast, high resolution graphics. And tools to connect the Apple to lab test equipment like function generators or plotters.

And we have tools to connect the Apple to the outside world, including A/D converters and interval timers with external interface.

We make components for the S-100 bus, the PET, and the TRS-80, too. We built our products to deliver hard-nosed value to the OEM, and to the inventor who knows the best, at prices that are unbeaten.

To find out how much computer your Apple II can be, see things our way. Because for serious users with serious uses for the Apple, we've got the tools.

California Computer Systems
250 Caribbean Sunnyvale, CA 94086 (408) 734-5811

CIRCLE 114 ON READER SERVICE CARD

Th the lig

ht and the Apple.

If you could talk to Thomas Edison, he'd tell you what it was like to turn the lights on in 1879. You could tell him about some bright ideas of the 20th century… particularly, a technological phenomenon that can handle everything from solar heat control to lighting your home via voice command. The Apple personal computer.

Expand your own inventiveness with the always-expandable Apple.

Take a look inside your local computer store. There's a range of Apple systems for you…whether you want expansion capabilities of four or eight accessory slots…or memory expandable to 64K bytes or 128K bytes. With this kind of flexibility, the possibilities for creating your own computer system are endless.

Want to add an A to D conversion board? Apple makes it happen. Want to plug into time sharing, news and electronic mail services? Apple does it all. Because Apple is the most popular personal computer with the least complicated interface, over 100 companies supply peripherals for the Apple family…including an IEEE 488 bus for instant control.

With Apple, Edison could've written a program to determine why some filaments burned longer than others.

Disk drives, a tool kit and creativity in color.

Apple was one of the first to use disk drives for increased performance and application versatility. Today, our 5¼″ disk drive offers high density (143K bytes) high speed and low cost. No wonder this drive is the most popular on the market.

But now Apple goes one better with the DOS Tool Kit. A series of utility programs, it gives you the freedom to easily design 280h x 192v graphic displays in a palette of living color…depending on your choice of Apple system.

Edison was first with the movie camera and projector. Now, with Apple's DOS Tool Kit, you can be first to work wonders with colorful creative animation.

Edison had the first movie camera…and Apple has the DOS Tool Kit that takes you into the colorful world of animation.

Imagine the broadest line of software programs ever.

Apple's broad line of peripherals is equalled only by the most extensive line of software you'll find in the personal computing world. Since more than 170 companies offer software for the Apple family, you can have one of the most impressive program libraries ever.

When you write your own programs, your Apple speaks creatively in BASIC, Pascal, FORTRAN, PILOT and 6502 assembly language. Use these languages to score a sonata. Apple will play back your musical masterpiece on its built-in speaker.

Edison listened to his voice on a revolutionary phonograph in the 1800s… now you can listen to the sounds of today with Apple's inventive family of personal computers.

Where to find even more illuminating Apple experiences.

There's always something new being invented at Apple to set your imagination soaring. And there's always an expert to tell you all about it in detail. Your Apple dealer. If you already own an Apple, there's a whole future ahead to challenge man, mind and machine.

If you're considering a personal computer, stop by the computer store and compare. Apple's reliability, proven performance and recognized technological leadership will help you see the light. Don't let history pass you by. Visit your nearest Apple dealer, or call 800-538-9696. In California, 800-662-9238.

apple® computer

CIRCLE 103 ON READER SERVICE CARD

Ramblings, cont'd...

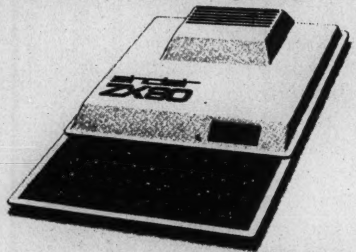
HAND HELD COMPUTER

A Quasar/Panasonic hand-held computer.

addressing and thus virtually unlimited expandability and interchangeability of peripheral devices. The HHC peripherals are able to work together in any combination and from any I/O slot. A basic HHC unit utilizes a continuous dot LCD panel that facilitates graphics, foreign character alphabets as well as full upper and lower case ASCII. In addition, the unit is able, with an optional peripheral, to drive a display on a standard TV set; other plug-in modules include expandable RAM, expandable ROM, and an expansion unit for up to four additional capsules, a cassette interface, printer, acoustic coupler and I/O driver. The entire expanded unit fits in a briefcase. Pricing was not firmly announced; however, Panasonic allowed that the HHC module would run around $400 and with the interface and time sharing module an additional $700.

Sinclair Research Ltd.

Sinclair formally introduced to the American market the ZX-80 computer which was introduced in Britain several months ago. This unit is in an amazingly small, almost flat, 9" x 7" case; the whole thing weighs a mere twelve ounces. Yet it has a full keyboard with graphics symbols and a keyword entry system, which means that entire words can be entered with a single keystroke. The ZX-80 is programmable in the Basic language and has a unique error detection system that scans statements as they are being put in. It can also be programmed in machine language and will support a full range of peripherals such as printers, disks and, of course, extra memory. The ZX-80 uses a Z-80 microprocessor running at 3.25 MHZ, about twice the speed of a TRS-80. Best of all the list price of the ZX-80 is $199.95, including AC adapter and everything needed to connect the ZX-80 to any black and white or color TV set and to a standard cassette recorder. (We'll have a complete review of the ZX-80 in a forthcoming issue.)



The Sinclair ZX80 measures only 6x9 inches and weighs 12 ounces.

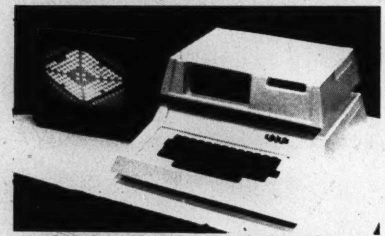
Larger Computers

Ohio Scientific

Ohio Scientific introduced the C1P Series 2, an enhanced version of the popular C1P/Superboard. The new Series 2 C1P offers sound, music and voice output capability via a digital-to-analog converter. It also offers twice the packing density of characters on screen thus overcoming one of the principal limitations in the original C1P; it also has a handsome plastic cabinet, replacing the wood and metal cabinet of the C1P. We don't know if this is a move in the right direction, but the styling is certainly a big improvement. The basic unit has an 8K work space which should be more than sufficient for any cassette based program. Retail price is $479.

A mini-floppy version, the C1P MF Series 2, comes complete with a disk operating system which allows the use of OS-65E, Ohio Scientific's business and development oriented system. In addition, OS-MDMS, a small data base management system, is available for use on the MF. This system allows the user to store collections of information on diskette for instant recall and analysis all without requiring any programming knowledge. The C1P-MF Series 2 lists at $1279.

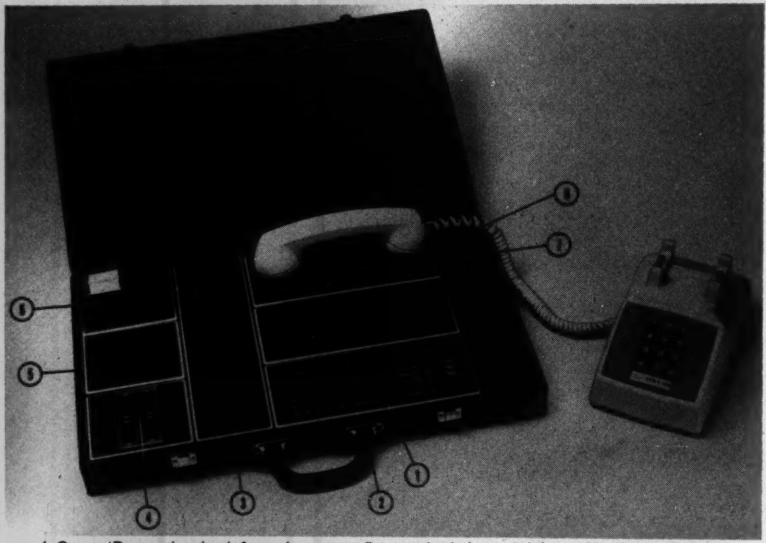
Both the C1P Series 2 computers may be expanded via the new 630/IO expander which provides color, dual joy stick operation, dual remote 10 keypad operation, AC remote control interface, programmable sound generator, program selectable modem in high speed quartz, and a home security interface. This expander lists for $229.



Ohio Scientific C1P MF Series 2 computer incorporates new housing and floppy disk.

Ohio Scientific also introduced the CHP HD computer system. This system is aimed at applications such as remotely controlling lights and appliances in a home without any wiring and monitoring security and activity in rooms via ultrasound detectors and door/window contacts. It may also be used with Ohio Scientific's universal telephone interface to originate and answer telephone calls utilizing its built-in voice I/O capability. This capability allows the CHP HD to understand and generate touch-tone signals or communicate with other computers via a built-in answer/originate modem. The system also utilizes a voice output system which stores 3500 common short words on the built-in hard disk. It then references an algorithm for phonetic generation of longer words by rules. This system of using "look up" for short words and a rule system for longer words allows the system to pronounce any word in the English language in relatively real time from conventional English spelling.

The system also incorporates voice recognition capability and can recognize up to 100 distinct words simultaneously.



A Quasar/Panasonic microinformation system fits completely into a brief case. Numbered items are: 1 - Hand-held computer, 2 - Memory, 3 - I/O driver, 4 - Expandable ROM for additional capsules, 5 - Cassette interface, 6 - Printers, 7 - Acoustic coupler, 8 - AC adapter.

"THE CREATOR®"

By Complete Business Systems, Inc. Software Division

High level language program generator develops complete programs in "Basic".

Enables ANYONE to write complete, running, debugged BASIC LANGUAGE Programs in 35 to 40 minutes with NO PRIOR PROGRAMMING KNOWLEDGE OR ABILITY.

Now available for TRS-80®, TRS-80 Model II®, Apple II®, Tandy 10®, Adds System 70 or 75®.

IF you are one of the many who bought a microcomputer in the belief that with just a little studying you could write your own programs, you now know that you can't.

IF you, as a businessman, thought you could have stock software modified at a reasonable cost with reasonable results, you know that's not possible either.

IF you are a hobbyist getting tired of the untold hours it takes to write a program, only to find it takes more hours to debug than to write . . .

IF you are a skilled programmer you don't have to be reminded of the repetitious time spent on each new application.

IF you have left your micro-computer sitting somewhere gathering dust . . . meet **"THE CREATOR®"**.

"THE CREATOR®" is not just another data base generator!

"THE CREATOR®", at your direction, makes complete running programs that are thoroughly documented, easy to modify at any time by YOU!

"THE CREATOR®" cuts programming time up to 90% for a skilled programmer.

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"THE CREATOR®" does the work! You answer the simple direct questions and **"THE CREATOR®"** CREATES . . . AND ALL IN BASIC LANGUAGE.

Q. After "THE CREATOR®" has produced a program, can it be modified?

A. Yes, the resulting program is modular, fully documented and readily accessible for alterations or deletions.

Q. Does the program created use so much disc space that there is very little space left for record storage?

A. No, the code produced is extremely compact despite complete documentation. If requested **"THE CREATOR®"** will even "pack" or compress information. You may even delete the "remarks" making it even more space efficient.

Q. Must I be expert or even conversant with Basic Language?

A. No, all questions to and answers from the operator require no computer language knowledge, simple every day English will do.

Q. What about math ability?

A. If you can count your fingers and toes, you'll have no problems.

Q. Will the programs which I produce with "THE CREATOR®" be bulky, slow or amateurish?

A. No, the resulting programs will be sophisticated and extremely fast operating. For example, should you create a mailing list or inventory program, the time for any record to be retrieved and displayed from a full disc would take a maximum of 1 second.

Q. Must the programs produced conform to a predetermined format and file length?

A. No, you determine format and file size to fit your requirements. You may have as many as 22 fields or as few as 1.

Q. Can I develop my own business programs?

A. For the most part, yes.

Q. What are the limitations? What programs can I produce with "THE CREATOR®"?

A. Your own ingenuity and hardware limitations.

Q. Will future versions of "THE CREATOR®" make my present copy obsolete?

A. The purchase price includes your original diskette and user instructions. Your program is registered in your name. For a period of one year from the date of purchase you will be entitled to receive FREE any improvements or modifications. The only expense to you will be a new diskette charge (if applicable), packaging and mailing.

TECHNICAL ASPECTS

- Record access by a hashing algorithm guaranteeing fast record retrieval.
- Duplicate keys permitted.
- Record deletion automatically supported.
- Record access and file maintenance is user transparent.
- Minimal disc overhead since there is no special assembly language routine called. No "Basic" overhead.
- Programs produced can be transported between 6800, 6502, 8080, Z80, 8085, 8086 and Z8000 based systems.
- Can be used with Micro-Soft Basic and CP/M systems.
- On TRS-80 has automatic blocking for maximum number of records per disc.
- Complete file maintenance including up-date of any record in any field, delete and add new records even with duplicate key.

We are seeking qualified dealers and distributors to handle our growing software lines. Address inquiries, on your company letterhead, to: Complete Business Systems, Inc., Software Division, 9420 W. Foster Ave., Chicago, Illinois 60656.

Enclosed is my check (or money order) in the amount of $250.00. Please send me my serial numbered, registered copy of **"THE CREATOR"** as soon as my check clears. (No wait for Certified checks, bank checks or money orders.) Sorry, no credit cards accepted.

(Please print)____________________

Full name ____________________

Address ________________ Apt. # ________

City __________ State ________ Zip ________

Computer make ____________ Model ____________

CIRCLE 153 ON READER SERVICE CARD

Prices reflect distribution on 8" single density diskettes. If a format is requested which requires additional diskettes, a surcharge of $8. per additional diskette will be added. A surcharge of $25 will be added for software on CSSN format DC 300XL cartridges. Media charge for 5440 disk is $100.

No. 16: Take a byte.

Genuine CP/M for Apple II Available now!

All Lifeboat programs require CP/M, unless otherwise stated.

Software for most popular 8080/Z80 computer disk systems

Software with Manual / Manual Alone

☐ **CP/M* FLOPPY DISK OPERATING SYSTEM**—Digital Research's operating system configured for many popular micro-computers and disk systems:

System	Version	Price	
New Apple II* SoftCard* with Z80 Microsoft BASIC version 5 with high resolution graphics	2.x	350/25	◇
North Star Single Density	1.4	145/25	Ⓥ
North Star Double Density	1.4	145/25	
North Star Single Density	2.x	170/25	
North Star Double/Quad	2.x	170/25	
Durango F-85	2.x	170/25	
iCOM Micro-Disk 2411	1.4	145/25	
iCOM 3712	1.4	170/25	Ⓥ *
iCOM 3812	1.4	170/25	*
Mits 3202/Altair 8800	1.4	145/25	
Heath H8 + H17	1.4	145/25	Ⓜ
Heath H89	1.4	145/25	Ⓜ
Heath H89 by Magnolia	1.4	250/25	◇
Heath H89 by Magnolia	2.x	300/25	◇
Onyx C8001	2.x	300/25	◇
Ohio Scientific C3	2.x	200/25	
TRS-80 Model I	1.4	145/25	Ⓜ
TRS-80 Model II	2.x	170/25	
TRS-80 Model II + Corvus	2.x	250/25	
Processor Technology Helios II	1.4	145/25	
Cromemco System 3	1.4	145/25	
Intel MDS Single Density	1.4	145/25	
Intel MDS Single Density	2.x	170/25	
Micropolis Mod I	1.4	145/25	Ⓥ
Micropolis Mod II	1.4	145/25	Ⓥ

The following configurations are scheduled for release soon:

North Star Double/Quad + Corvus	2.x	250/25	
North Star Horizon HD-1	2.x	250/25	
Ohio Scientific C3-C	2.x	250/25	
Micropolis Mod II	2.x	200/25	
Mostek MDX STD Bus System	2.x	350/25	**
iCOM 3812	2.x	225/25	*
iCOM 4511/Pertec D3000	2.x	375/25	*+

*Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked Ⓜ require the special Ⓜ versions of software in this catalog. Systems marked Ⓥ have minor variants available to suit console interface of system. Call or write for full list of options. ◇ includes hardware addition to allow our standard versions of software to run under it.*

☐ Ⓜ Ⓩ **Z80 DEVELOPMENT PACKAGE**—Consists of: (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file .... **$95/$20**

☐ Ⓜ Ⓩ **ZDT**—Z80 Monitor Debugger to break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. $35 when ordered with Z80 Development Package .... **$50/$10**

AVOCET SYSTEMS

☐ **XASM-68**—Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to Intel hex ... **$200/$25**

☐ **XASM-65**—As XASM-68 for MOS Technology MCS-6500 series mnemonics ...... **$200/$25**

☐ **XASM-48**—As XASM-68 for Intel MCS-48 and UPI-41 families .... **$200/$25**

☐ **XASM-18**—As XASM-68 for RCA 1802 .... **$200/$25**

☐ **DISTEL**—Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files, Intel or TDL/Xitan pseudo ops optional. Runs on 8080 .... **$65/$10**

☐ Ⓜ Ⓩ **DISILOG**—As DISTEL to Zilog/Mostek mnemonic files .... **$65/$10**

Software with Manual / Manual Alone

☐ Ⓧ **SMAL/80** Structured Macro Assembler Language—Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs .... **$75/$15**

PHOENIX SOFTWARE ASSOCIATES

New ☐ Ⓩ **PASM***—Z80 macro assembler, Intel/TDL mnemonics. Generates Intel hex format or relocatable code in either TDL Object Module format or PSA Relocatable Binary Module format. Supports text insertion, conditional branching within macros, recursive macro calls and parameter passing. .... **$129/$25**

New ☐ Ⓩ **EDIT**—Character oriented text file editor. Includes macro definition capabilities. Handles insertion, deletion, searching, block move, etc. for files of any length. Does not require a CRT. .... **$129/$25**

New ☐ Ⓩ **PLINK***—Two pass **disk-to-disk linkage editor/loader** which can produce re-entrant, ROMable code. Can link programs that are larger than available memory for execution targeted on another machine. Full library capabilities. Input can be PSA Relocatable Binary Module, TDL Object Module or **Microsoft REL files**. Output can be a COM file, Intel hex file, TDL Object Module or PSA Relocatable file. .... **$129/$25**

New ☐ Ⓩ **BUG* and μBUG***—Z80 interactive machine level debugging tools for program development. BUG has full symbolic trace and interactive assembly (mnemonics compatible with PASM). Dynamic breakpoints and conditional traps while tracing (even through ROM!). μBUG is a subset of BUG and is used in memory limited situations .... **$129/$25**

DIGITAL RESEARCH

☐ **MP/M**—Installed for single density MDS-800. Multi-processing derivative of the CP/M operating system. Manual includes CP/M2 documentation .... **$300/$50**

☐ Ⓢ **MAC-8080**—Macro assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Produces absolute hex output plus symbol table file for use by SID and ZSID (see below) **$120/$15**

☐ Ⓢ **SID-8080**—Symbolic debugger. Full trace, pass count and breakpoint program testing. Has backtrace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values . **$105/$15**

☐ Ⓢ Ⓩ **ZSID-Z80**—Symbolic debugger with all features of SID .... **$130/$15**

☐ Ⓢ **TEX**—Text output formatter to create paginated, page-numbered and justified copy. Output can be directed to printer or disk ... **$105/$15**

☐ Ⓢ **DESPOOL**—Utility program to permit simultaneous printing from text files while executing other programs .... **$80/$10**

☐ Ⓧ **tiny C**—Interactive interpretive system for teaching structured programming techniques. Manual includes full source listings . **$105/$50**

☐ Ⓜ Ⓘ **BDS C COMPILER**—Supports most features of language, including Structures, Arrays, Pointers, recursive function evaluation, overlays. Includes linking loader, library manager, and library containing general purpose, file I/O, and floating point functions. Lacks initializers, statics, floats and longs. Documentation includes "The C PROGRAMMING LANGUAGE" by Kernighan and Ritchie .... **$145/$25**

☐ Ⓛ Ⓧ **WHITESMITHS C COMPILER**—The ultimate in systems software tools. Produces faster code than a pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M ..... **$630/$30**

MICROSOFT

☐ Ⓛ Ⓜ **BASIC-80**—Disk Extended BASIC, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records .... **$325/$25**

☐ Ⓛ Ⓜ **BASIC COMPILER**—Language compatible with BASIC-80 and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules .... **$350/$25**

Software with Manual / Manual Alone

☐ Ⓛ Ⓜ **FORTRAN-80**—ANSI 66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) .... **$425/$25**

☐ Ⓛ Ⓜ **COBOL-80**—Level 1 ANSI '74 standard COBOL plus most of Level 2. Full sequential, relative, and indexed file support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80 .... **$700/$25**

☐ Ⓛ Ⓜ **MACRO-80**—8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included .... **$149/$15**

New ☐ Ⓛ **muSIMP/muMATH**—muSIMP is a high level programming language suitable for symbolic and semi-numerical processing. Implemented using a fast and efficient interpreter requiring only 7K bytes of machine code. muMATH is a package of programs written in muSIMP. The package performs sophisticated mathematical functions. Keeps track of up to 611 digits. Performs matrix operations on arrays: transpose, multiply, divide, inverse and other integer powers. Logarithmic, exponential, trigonometric simplification and transformation, symbolic differentiation with partial derivatives, symbolic integration of definite and indefinite integrals. Requires 40K CP/M. .... **$250/$20**

New ☐ Ⓛ **muLISP-79**—Microcomputer implementation of LISP. The interpreter resides in only 7K bytes of memory yet includes 83 LISP functions. Has infinite precision integer arithmetic expressed in any radix from 2 to 36. muLISP-79 includes complete trace facility and a library of useful functions and entertaining sample programs. .... **$200/$15**

☐ Ⓛ **XMACRO-86**—8086 cross assembler. All Macro and utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available .... **$275/$25**

☐ Ⓛ **EDIT-80**—Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included. .... **$89/$15**

☐ Ⓧ **PASCAL/M***—Compiles enhanced Standard Pascal to compressed efficient Pcode. Totally CP/M compatible. Random access files. Both 16 and 32-bit Integers. Runtime error recovery. Convenient STRINGs. OTHERWISE clause on CASE. Comprehensive manual (90 pp. indexed). SEGMENT provides overlay structure. INPORT, OUTPORT and untyped files for arbitrary I/O. Requires 56K CP/M. Specify 1) 8080 CP/M, 2) Z80 CP/M, or 3) Cromemco CDOS. .... **$175/$20**

☐ Ⓘ Ⓩ **PASCAL/Z**—Z80 native code PASCAL compiler. Produces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, relocating assembler and linker, and source for all library modules. Variant records, strings and direct I/O are supported. Requires 56K CP/M .... **$395/$25**

☐ Ⓜ Ⓧ **PASCAL/MT**—Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Includes strings enumerations and record data types. Manual explains BASIC to PASCAL conversion. Requires 32K .. **$250/$30**

New ☐ Ⓛ Ⓩ **APL/V80**—Concise and powerful language for application software development. Complex programming problems are reduced to simple expressions in APL. Features include up to 27K active workspace, shared variables, arrays of up to 8 dimensions, disk workspace and copy object library. The system also supports auxiliary processors for interfacing I/O ports. Requires 48K CP/M and serial APL printing terminal or CRT .... **$500/$30**

☐ Ⓩ **ALGOL-60**—Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. .... **$199/$20**

☐ Ⓜ **CBASIC-2** Disk Extended BASIC—Non-interactive BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. .... **$120/$15**

MICRO FOCUS

☐ Ⓛ **STANDARD CIS COBOL**—ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal .... **$850/$50**

Software with Manual / Manual Alone

☐ Ⓛ **FORMS 2**—CRT screen editor. Output is COBOL data descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by STANDARD CIS COBOL .... **$200/$20**

EIDOS SYSTEMS

☐ Ⓛ **KISS**—Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. .... **$335/$23**

☐ Ⓛ **KBASIC**—Microsoft Disk Extended BASIC version 4.51 integrated by implementation of nine additional commands in language. Package includes KISS. REL as described above, and a sample mail list program. .... **$585/$45**
To licensed users of Microsoft BASIC-80 (MBASIC) .... **$435/$45**

☐ **XYBASIC** Interactive Process Control BASIC—Full disk BASIC features plus unique commands to handle byte rotate and shift and to test and set bits. Available in several versions:

Integer ROM squared	**$350/$25**
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Extended Disk CP/M	**$550/$25**
Integer CP/M Run Time Compiler	**$350/$25**
Extended CP/M Run Time Compiler	**$450/$25**

☐ **RECLAIM**—A utility to validate media under CP/M. Program tests a diskette or hard disk surface for errors, reserving the imperfections in invisible files, and permitting continued usage of the remainder. Essential for any hard disk. Requires CP/M version 2. ...... **$80/$5**

☐ Ⓜ **BASIC UTILITY DISK**—Consists of: (1) CRUNCH-14— Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC 4.51, BASIC-80 and TRS-80 BASIC. (2) DPFUN—Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sine, arc sine, hyperbolic sine, hyperbolic arc sine, etc. Furnished in source on diskette and documentation .... **$50/$35**

☐ **STRING/80**—Character string handling plus routines for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format. **$95/$20**

☐ **STRING/80** source code available separately— **$295/NA**

☐ Ⓜ **THE STRING BIT**—FORTRAN character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source .... **$65/$15**

☐ Ⓜ **VSORT**—Versatile sort/merge system for fixed length records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. .... **$175/$20**

☐ **CPM/374X**—Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files .... **$195/$10**

Coming Soon

CPAids*

☐ Ⓛ † **MASTER TAX**—Professional tax preparation program. Prepares schedules A, B, C, D, E, F, G, R/RP, SE, TC, ES and forms 2106, 2119, 2210, 3468, 3903, 2441, 4625, 4726, 4797, 4972, 5695 and 6521. Printing can be on readily available, pre-printed continuous forms, on overlays, or on computer generated, IRS approved forms. Maintains client history files and is interactive with CPAids GENERAL LEDGER II (see below) .... **$995/$30**

☐ † **STANDARD TAX**—As above for schedules A, B, C, D, E, G, R/RP, SE, TC and forms 2106 and 2441. Also, does not maintain client history files .... **$495/$30**

☐ † **GENERAL LEDGER II**—Designed for CPA's. Stores complete 12 month detailed history of transactions. Generates financial statements, depreciation, loan amortizations, journals, trial balances, statements of changes in financial position, and compilation letters. Includes payroll system with automatic posting to general ledger. Prints payroll register, W2's and payroll checks. .... **$450/$30**

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Software with Manual / Manual Alone

New

☐ **T/MAKER**—Powerful new tool for preparing management reports with tabular data. Makes financial modeling projects easy. Do you want a weekly profitability report? Set up the table and compute. Just change the sales figures for next week and compute. You have a new report! T/MAKER includes a full screen editor for setting up tables which pages left, right, up and down. Compute includes standard arithmetic, percents, exponents, common transcendental functions, averages, maxima, minima, projections, etc. Requires 48K CP/M and CBASIC-2 .... **$275/$25**

☐ Ⓜ **BSTAM**—Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send *. COM, etc. 9600 baud with wire. 300 baud with phone connection. **Both** ends need one. Standard and Ⓜ versions can talk to one another. **.$150/$10**

☐ **WHATSIT?***—Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 **.$175/$25**

☐ † Ⓜ **SELECTOR III-C2**—Data Base Processor to create and maintain multi-key data bases. Prints formatted sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source ..... **$295/$20**

☐ **GLECTOR**—General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2. CBASIC-2 and 56K system. .... **$350/$25**

☐ **CBS**—Configurable Business System is a comprehensive set of programs for defining custom data files and application systems without using a programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval **with transaction processing**. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. **No support language required** .... **$295/$40**

MICRO DATA BASE SYSTEMS

☐ **HDBS**—Hierarchical Data Base System. CODASYL oriented with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/write protection at the FILE level. Supports FILEs which extend over multiple floppy or hard disk devices.

☐ **MDBS**—Micro Data Base System. Full network data base with all features of HDBS plus multilevel read/write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

New Features

New Manual

☐ **HDBS-Z80** version	**$250/$40****
☐ **MDBS-Z80** version	**$750/$40****

8080 version available at $75 extra.

When ordering, specify one of the language interfaces listed below. Additional language interfaces available at time of purchase for $100 or $125 if purchased later.

**The single manual covering HDBS and MDBS when purchased alone comes without specific language interface manual. Manuals are available for the following Microsoft languages:

1) MBASIC 4.51, 2) BASIC-80 5.0, 3) Compiled BASIC or FORTRAN-80, 4) COBOL-80, 5) MACRO-80. .... **$NA/$10**

MICROPRO

☐ Ⓛ **SUPER-SORT I**—Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! .... **$225/$25**

☐ Ⓛ **SUPER-SORT II**—Above available as absolute program only .... **$175/$25**

☐ Ⓛ **SUPER-SORT III**—As II without SELECT/EXCLUDE .... **$125/$25**

☐ Ⓛ **DATASTAR**—Professional forms control entry and display system for key-to-disk data capture. Menu driven with built-in learning aids. Input field verification by length, mask, attribute (i.e. upper case, lower case, numeric, auto-dup, etc.). Built-in arithmetic capabilities using keyed data, constant and derived values. Visual feedback for ease of forms design. Files compatible with CP/M-MP/M supported languages. Requires 32K CP/M .... **$350/$35**

Software with Manual / Manual Alone

☐ Ⓛ **WORD-STAR**—Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning .... **$445/$40**

☐ Ⓛ **WORD-STAR-MAIL-MERGE**—As above with option for production mailing of personalized documents with mail lists from DATASTAR or NAD .... **$575/$40**

☐ **WORD-STAR Customization Notes**—For sophisticated users who do not have one of the many standard terminal or printer configurations in the distribution version of WORD-STAR .... **$NA/$95**

☐ Ⓛ **WORD-MASTER** Text Editor—In one mode has superset of CP/M's ED commands including global searching and replacing, forwards and backwards in file in video mode, provides full screen editor for users with serial addressable-cursor terminal .... **$145/$25**

☐ Ⓜ **TEXTWRITER III**—Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil* and Word-Star prepared files .... **$125/$20**

New lower prices for application Software

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☐ Ⓛ † General accounting software for small businesses. Each product can be used alone or with automatic posting to the general ledger. Supplied in source for Microsoft BASIC 4.51.

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ACCOUNTS RECEIVABLE	**$530/$40**
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ALSO:	
MAILING ADDRESS	**$530/$40**
PROPERTY MANAGEMENT	**$925/$40**

GRAHAM-DORIAN SOFTWARE SYSTEMS

☐ Ⓛ Ⓜ † Comprehensive accounting software written in CBASIC-2 and supplied in source code. Each software package can be used as a stand-alone system or integrated with the General Ledger for automatic posting to ledger accounts. Requires CBASIC-2.

GENERAL LEDGER	**$805/$40**
ACCOUNTS PAYABLE	**$805/$40**
ACCOUNTS RECEIVABLE	**$805/$40**
INVENTORY SYSTEM	**$555/$40**
JOB COSTING	**$805/$40**
APARTMENT MANAGEMENT	**$805/$40**
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☐ Ⓜ **POSTMASTER**—A comprehensive package for mail list maintenance that is completely menu driven. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Includes NAD file translator. Requires CBASIC-2 .... **$150/$20**

STRUCTURED SYSTEMS GROUP

☐ † Complete interactive accounting software for business. Each product can be used stand-alone or with automatic posting to the general ledger. Each product is thoroughly tested and very well documented. Each product requires CBASIC-2.

GENERAL LEDGER	**$820/$40**
ACCOUNTS RECEIVABLE	**$820/$40**
ACCOUNTS PAYABLE	**$820/$40**
PAYROLL	**$820/$40**
INVENTORY CONTROL	**$820/$40**

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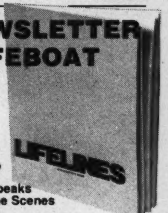

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Software with Manual / Manual Alone

☐ † **ANALYST**—Customized data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level break-points for summarization. Requires a disk sort utility such as QSORT, SUPER-SORT or VSORT and CBASIC-2 .... **$250/$15**

☐ **LETTERIGHT**—Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 .... **$200/$25**

☐ **NAD** Name and Address selection system—Interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 .... **$100/$20**

☐ **QSORT**—Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created .... **$100/$20**

CONDIMENTS

☐ **HEAD CLEANING DISKETTE**—Cleans the drive Read/Write head in 30 seconds. Diskette absorbs loose oxide particles, fingerprints, and other foreign particles that might hinder the performance of the drive head. Lasts at least 3 months with daily use. Specify 5" or 8".

Single sided	**$20 each/$55 for 3**
Double sided	**$25 each/$65 for 3**

☐ **FLIPPY DISK KIT**—Template and instructions to modify single sided 5¼" diskettes for use of second side in single sided drives **$12.50**

☐ **FLOPPY SAVER**—Protection for center holes for 5" and 8" floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool and tough 7 mil mylar reinforcing rings for 25 diskettes.

5", Kit	**$14.95**
5", Rings only	**$7.95**
8", Kit	**$16.95**
8", Rings only	**$8.95**

☐ **PASCAL USER MANUAL AND REPORT**—By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users **$12**

☐ **THE C PROGRAMMING LANGUAGE**—By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmiths C users . **.$12**

☐ **STRUCTURED MICROPROCESSOR PROGRAMMING**—By the authors of SMAL/80. Covers structured programming, the 8080/8085 instruction set and the SMAL/80 language **$20**

☐ **ACCOUNTS PAYABLE & ACCOUNTS RECEIVABLE—CBASIC**—By Osborne/McGraw-Hill **$20**

☐ **GENERAL LEDGER—CBASIC**—By Osborne/McGraw-Hill **$20**

☐ **PAYROLL WITH COST ACCOUNTING—CBASIC**—by Osborne/McGraw-Hill **$20**

☐ **LIFEBOAT DISK COPYING SERVICE**—Transfer data or programs from one media format to another at a moderate cost . **.from $25**

Hearty Appetite.

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PASM, PLINK, BUG and μBUG are trademarks of Phoenix Software Associates Ltd.
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† Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Ⓜ Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

Ⓛ User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

Ⓘ This product Includes/eXcludes the language
Ⓧ manual recommended in Condiments.

Ⓢ Serial number of CP/M system must be supplied with orders.

Ⓩ Requires Z80 CPU.

Ordering Information

MEDIA FORMAT ORDERING CODES
When ordering, please specify format code.

LIFEBOAT ASSOCIATES MEDIA FORMATS LIST
Diskette, cartridge disk and cartridge tape format codes to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system or language.

Computer system	Format Code
Altair 8800 Disk	See MITS 3200
Altos	A1*
Apple + SoftCard 13 Sector	RG
Apple + SoftCard 16 Sector	RR
BASF System 7100	RD
Blackhawk Single Density	Q3
Blackhawk Micropolis Mod II	Q2
CDS Versatile 3B	Q1
CDS Versatile 4	Q2
COMPAL-80	Q2
Cromemco System 3	A1*
Cromemco Z2D	R6
CSSN BACKUP (tape)	T1 #
Delta	A1*
Digi-Log Microterm II	RD
Digital Microsystems	A1*
Discus	See Morrow Discus
Durango F-85	RL
Dynabyte DB8/2	R1
Dynabyte DB8/4	A1*
Exidy Sorcerer + Lifeboat CP/M	Q2
Exidy Sorcerer + Exidy CP/M	Q4
Heath H8 + H17/H27	P4
Heath H89 + Lifeboat CP/M	P4
Heath H89 + Magnolia CP/M	P7
Helios II	See Processor Technology
Horizon	See North Star
iCOM 2411 Micro Floppy	R3
iCOM 3712	A1
iCOM 3812	A1*
iCOM 4511 5440 Cartridge CP/M 1.4	D1 #
iCOM 4511 5440 Cartridge CP/M 2.2	D2 #
IMS 5000	RA
IMS 8000	A1*
IMSAI VDP-40	R4**
IMSAI VDP-42	R4**
IMSAI VDP-44	R5**
IMSAI VDP-80	A1**
Intecolor	See ISC Intecolor
Intel MDS Single Density	A1
Intertec SuperBrain DOS 0.1	R7
Intertec SuperBrain DOS 0.5-2.X	RJ
Intertec SuperBrain DOS 3.X	RK
ISC Intecolor 8063/8360/8963	A1
Kontron PSI-80	RF
Meca 5¼"	P6
Micromation (Except TRS-80 below)	A1*
Micropolis Mod I	Q1
Micropolis Mod II	Q2
MITS 3200/3202	B1
Morrow Discus	A1*
Mostek	A1
MSD 5¼"	RC
North Star Single Density	P1
North Star Double/Quad	P2
Nylac Single Density	Q3
Nylac Micropolis Mod. II	Q2
Ohio Scientific C3	A3
Onyx C8001	T2 #
Pertec PCC 2000	A1*
Processor Technology Helios II	B2
Quay 500	RO
Quay 520	RP
RAIR Single Density	R9
RAIR Double Density	RE
Research Machines 8"	A1
Research Machines 5¼"	RH
REX	Q3
Sanco 7000 5¼"	RQ
SD Systems 8"	A1*
SD Systems 5¼"	R3
Sorcerer	See Exidy Sorcerer
Spacebyte	A1
SuperBrain	See Intertec
Tarbell	A1*
TEI 5¼"	R3
TEI 8"	A1*
Thinkertoys	See Morrow Discus
TRS-80 Model I 5¼"	R2
TRS-80 Model I + FEC Freedom	RN
TRS-80 Model I + Micromation	A4*
TRS-80 Model I + Omikron 5¼"	RM
TRS-80 Model I + Omikron 8"	A1
TRS-80 Model I + Shuffleboard 8"	A1
TRS-80 Model II	A1*
VDP-40/42/44/80	See IMSAI
Vector MZ	Q2
Versatile	See CDS Versatile
Vista V80 5¼" Single Density	P5
Vista V200 5¼" Double Density	P6
Zenith Z89 + Lifeboat CP/M	P4
Zenith Z89 + Magnolia CP/M	P7

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.

* Single-Side Single-Density disks are supplied for use with Double-Density and Double-Side 8" soft sector format systems.

** IMSAI formats are single density with directory offset of zero.

A media surcharge of $25 for orders on tape formats T1 and T2 and of $100 for orders on disk formats D1 and D2 will be added.

The list of available formats is subject to change without notice. In case of uncertainty, call to confirm the format code for any particular equipment.

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Overhead view of the upstairs part of CES, the total exhibit area is roughly four times that shown in this photograph.

We saw this being demonstrated in perhaps less than ideal circumstances in a hospitality suite and the computer was having some trouble distinguishing between yes and no. Obviously this could lead to major problems in utilizing the system. However, in a quieter, stress-free environment the system may well prove to be more reliable. List price is in the $10,000 range.

Atari Inc.

Atari introduced a new piece of software, the Atari Accountant and three new peripherals. They also showed three peripherals which we hadn't seen before.

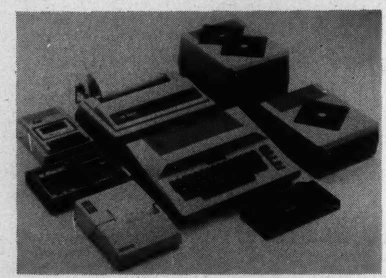
The Atari Accountant was "created to give the small businessman the benefit of computerization without special training or the time required to learn computer programming." It seems to be aimed at the businessman who does his own bookkeeping or who has a part time bookkeeper. The Atari Accountant consists of a general ledger master module, with accounts receivable and payable available as independent add-on modules. Atari promises an inventory control and order entry module at a later date. The Atari Accountant requires a dual disk configuration, 80 column printer—and RS232 interface module. We'll reserve judgement on this system until we see it in operation.

The Atari CX70 Light Pen is a new controller that enables users to paint multicolored screens on the scene, pick items from a menu, play games, direct geometric calculations, and do I/O operations in Basic programs simply by pressing the pen to the television screen. The Light Pen reads the coordinates of the TV electron beam as the beam passes by. This is a somewhat different approach than used by some other light pens which operate simply on light and dark. The Light Pen plugs into one of the four controller jacks. List price is $74.95.

The Atari 815 is a dual disk drive with double density on 40 tracks per diskette. Using this storage system each diskette stores over 163,000 bits of data. The dual drive has a built-in microprocessor for control and includes DOS/FMS (double density disk operating system/file management system). List price for the 815 is $1499.95.

The third new peripheral is the Atari 822 Thermal Printer. This prints out programs and information on white thermal paper at a rate of 37 characters per second. It is compact and light weight (less than 6 pounds) and prints bidirectionally. This forty column printer carrys a list price of $449.95.

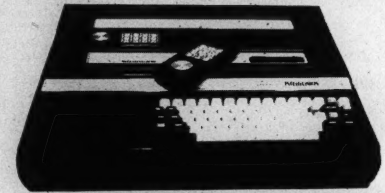
Three previously announced peripherals include the Atari 825 Dot Matrix printer. This printer has three different spacings, 10, 14 or 16.7 characters per inch; with these different spacings the printer can print from 80 to 132 characters per line. Normal print speed is 79 to 83 characters per second. The printer also has the capability of double width characters. It requires the Atari 850 interface module to connect the printer to the computer. This interface module has four serial interface ports for use with a 830 Acoustic modem and other RS 232C peripherals. It also has a parallel output in interface port which supports the Atari 825 printer. Programmable baud rates are available on any port from 75 to 9600 bits per second. The Atari 830 modem is a stand-alone acoustically coupled telephone modem. It has full and half duplex operation and answer/originate and test modes. It also requires an interface module to connect it to the computer. Prices of these products are $999.95 for the 825 printer, $199.95 for the 830 acoustic modem and $219.95 for the interface module.



The entire Atari array. Clockwise from lower right acoustic modem, 800 microcomputer, 822 thermal printer, 850 RS-232 interface module, 410 program recorder, 825 80 column dot matrix printer, 815 dual disk drive and 810 single disk drive.

Mattel Electronics

In a virtual repeat of the 1979 Consumer Electronic Show, Mattel was showing their INTELLIVISION with lots of cartridge games available for it. Once again they announced the keyboard unit for test marketing in the fall and delivery next year, i.e., the spring of 1981.



Mattel's INTELLIVISION showing the keyboard unit promised for delivery in early 1981.

Meantime six new cartridges were announced for the master unit: Soccer, Golf, Skiing, Boxing, Tennis and Sea Battle. We commented on the unique hand held controllers last year. Each controller has twelve touch sensitive buttons, four play action keys on the side and a 16 direction control disk for precise movement of screen objects. Custom overlays for each hand held controller comes with each cartridge and fit directly over the controller completely integrating each program with the controller. This design is considerably more user-oriented than many of the other controllers on the market. The 16-bit microprocessor in the master unit delivers a full range of simulated sound effects, three part harmony and exceptional color reproduction with its high resolution graphics. The master component and controllers are well designed and impressive, however we still await the keyboard component before passing full evaluation on the Mattel INTELLIVISION.

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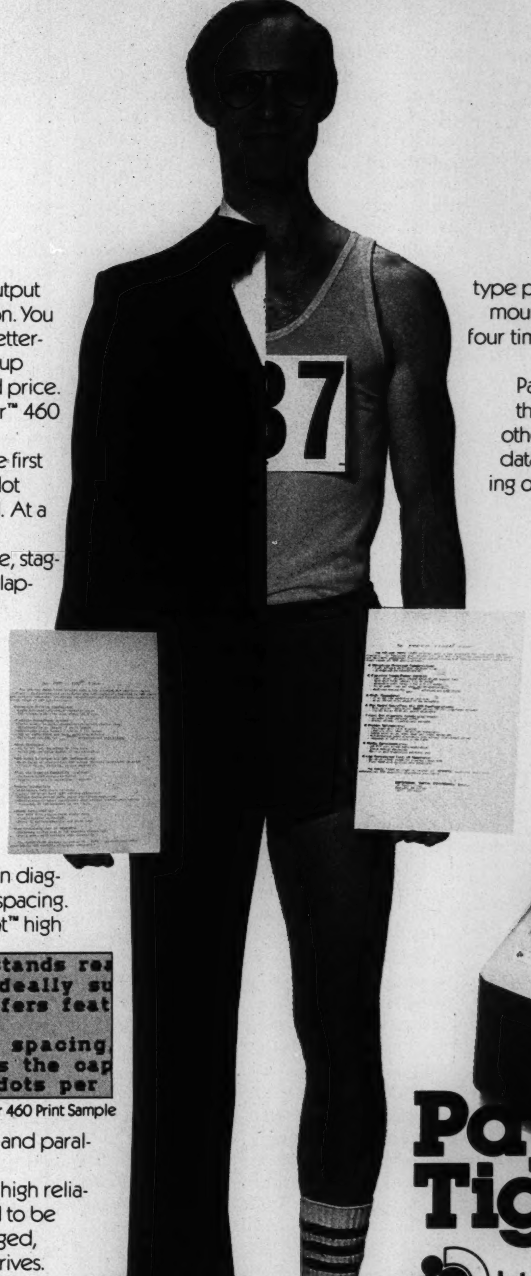

Until now, word processing output was a slow, expensive proposition. You could pay thousands for a slow, letter-quality character printer. Or give up print quality for matrix speed and price.

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Paper Tiger 460 Print Sample

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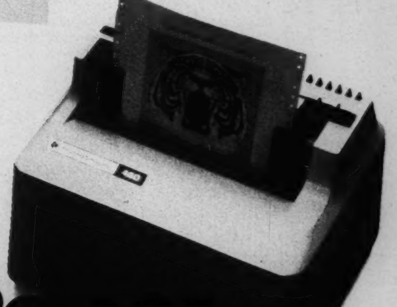


Paper Tiger 460

Integral Data Systems, Inc.

*Suggested single-unit U.S. retail price.
†Apple is a trademark of Apple Computer Inc.
‡TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

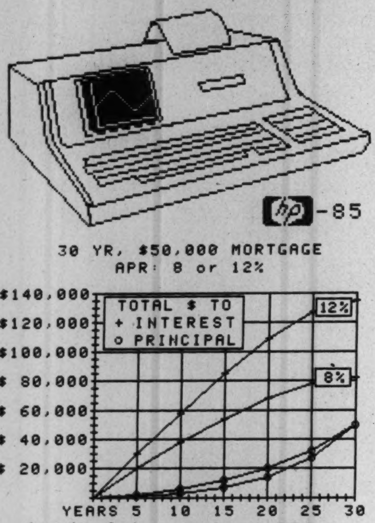
CIRCLE 246 ON READER SERVICE CARD

Ramblings, cont'd...

Hewlett Packard

HP was showing off its new HP-85 computer and several peripherals. One rather impressive one was a plotter which had the ability to plot four colors. This is not the simultaneous color plotter but one which allows you to change the pen after it is finished drawing a line or a portion of a diagram. The HP-85 is a very impressive computer; while the screen size is relatively small, measuring about 4 inches across, it has extremely high resolution one color graphics. These graphics may be reproduced on the built-in dot matrix thermal printer. We've come to expect excellent design and very high reliability from HP products and this computer looks like no exception (watch *Creative Computing* for a complete review of it in the near future).

HP 85 with plotter.



A portion of printout tape from the HP 85.

Bally

As noted elsewhere in this issue, Bally has sprung back into life and resurrected their computer which they originally called the Video Arcade now renamed the Bally Computer System. The price is a modest $300. Thirteen plug-in ROM modules, mostly games, are available for the system at this time. In addition a plug-in module containing Basic is available and an audio interface to store programs on a cassette recorder.

New Software Packages

Texas Instruments

TI announced seven new solid state software command modules along with six new software packages on floppy disk or cassette. The command modules include a Tax Investment/Record Keeping program. This module automatically totals assets, liabilities, income and expense transactions by category and subcategory for both month and year to date totals. List price $69.95. The Personal Real Estate module is designed to give the user quantitative tools for evaluating personal real estate investments and provide him with a better understanding of possible alternative investments. Areas addressed include projected income, cash flow, various types of financing and depreciation, rate of return and tax calculations. Price is $69.95.

The third package, "Weight Control and Nutrition," was developed in conjunction with Better Homes and Gardens and provides the user with a healthful weight control program. It is designed for homemakers seeking to plan balanced meals for the entire family. Dietary guidelines are incorporated to create menus based on each user's preferences, nutrient requirements and target calorie intake. List price is $59.95.

The Music Maker command module allows the user to arrange notes on a staff and hear the results played instantly. (We'll reserve judgement on this one until we've had it here to evaluate.) List price is $39.95.

Three other game modules are also available: Soccer, Mind Challengers (yet another version of Simon and Concentration) and Hunt the Wumpus (ripped off from PCC and/or *Creative Computing.* Perhaps we should feel honored to be ripped by the big guys. Radio Shack and Atari both sell my Hammurabi program without a single line changed for their computers and now TI is selling Gregory Yob's Hunt the Wumpus Program for the 99/4. Why don't we sue? Because it would take far more resources and money to institute a suit than we could possibly expect in a settlement, although one of these days somebody is going to cross over that line and we are going to take some action).

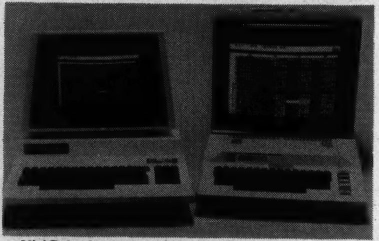
Floppy disk and cassette based software for the 99/4 includes a mailing list program which helps alphabetize, organize, index, retrieve, install all sorts of information from names, addresses and phone numbers to club rosters, Christmas card lists and more. Available on disk only, the price for this program is $69.95.

TI 99/4 with new floppy disk and printer.

TI-trek is another version of Star Trek, again first published as Super Star Trek in *Creative Computing* some four years ago. Price for this disk is $14.95. Other tapes and disks include personal finance aids, programming aids and a math programming library.

Personal Software

Although we had seen the Atari version just a few weeks before, we had a little more time to observe "VisiCalc," Personal Software's highly respected package that turns a personal computer display into an interactive electronic workshop. Shown here at CES were versions that run on the Commodore PET and Atari 800 (for a complete review, see the August 1980 issue of *Creative Computing).*



VisiCalc shown running on a Pet and Atari 800.

Compucolor

Compucolor introduced a family of software packages, "Execugraph" for the Compucolor III (32K model only). These programs are designed to provide color graphic displays of data in addition to the usual tabular printout that is normally associated with management information. This system can be used to conduct analyses of sales, inventory, production, expenses and a variety of other data-intensive functions. The Execugraph programs allow the creation of bar charts, line charts, scatter graphs and filled line or area graphs utilizing the information already existing in the user's data files. The scaling of graphs is completely automatic while rescaling and color changes are facilitated by simple user commands.

Execugraph also includes statistical tools for forecasting and data analysis. These tools include trend line forecasting, exponential smoothing, simple linear regressions, moving averages, compound growth calculations and six other analyses.

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1184-616 p.—The Master Guide To Electronic Circuits ($19.95)

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CIRCLE 191 ON READER SERVICE CARD

Ramblings, cont'd...

APF Electronics

APF released a Basic tutor program at CES. This cassette is a self-paced step-by-step hands-on technique for learning how to program in Basic. The program provides instant feedback with its input monitoring system that tells the user when a mistake was made and why. The program guides new users in developing personal programs, learning the language and expanding their knowledge of key words. The Basic tutor has an accompanying text with six chapters containing twenty-two lessons which instruct in computer language, art and music. Lessons guide the user by example and illustrate a working usable program. List price is $49.95.

Like almost everyone else, APF also showed a Space Invaders type of game, "Space Destroyer" for the Imagination Machine.

APF Imagination Machine playing Space Destroyer.

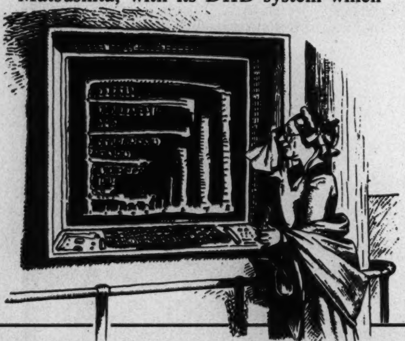
In addition, APF showed several prototype add-on modules for the Imagination Machine. The first, the "Building Block," provides both serial and parallel ports to other peripherals. A 40 column thermal printer is able to be plugged into the Building Block and prints two lines per second. A dual minifloppy disk provides up to 72,000 bits of storage capacity per disk. The Building Block includes a cartridge with a standard RS-232 port that can be used to drive a printer or modem. It has 8 baud rates selectable from 110 to 9600. The Building Block also has a way of adding additional memory (in 8K increments) to the Imagination Machine. Total price of the Imagination Machine, expansion box and floppy disk will run around $1000. The last peripheral, a modem, allows the Imagination Machine to talk to other computers or access other data bases.

Marty Lipper of APF indicated that they would be bringing out some business oriented packages for the Imagination Machine. I questioned him about this strategy since with the Imagination Machine largely positioned as a game playing entertainment system, it seemed incongruous to bring out inventory, payroll and other business packages. Marty countered by saying that for many small businessmen the cost of $2000 on up for a computer system was prohibitive and that a machine with floppy disk for a $1000 would be more attractive and could do some business functions. Given APF's position in the business calculator market, they may be able to pull this off. Personally, I have my doubts.

Video Products

As long time readers of *Creative Computing* know, we are quite excited about the advent of the video disk and its tremendous potential for storing large data bases and making them available at very low prices. We've been leaning toward the Phillips/MCA Optical Disk System. Since it stores its information in a binary format, it seems more suitable for storing computer software. Now two companies, Magnavox and Pioneer, are both selling versions of the Phillips-developed optical disk player. Apparently the Atlanta and Seattle test markets were quite successful, so Magnavox is now rolling the model DH8000 Video Disk player out in some 18 additional markets. In addition, Pioneer is scheduled to deliver its version of the optical system in four more markets. Phillips is also supported by such corporate behemoths as IBM, which together with MCA has formed Disco Vision Associates, a software production venture set up to support optical player marketing. So far no computer software has been released but clearly with IBM in the venture, that can't be far behind. The Magnavox player lists for $775 and the Pioneer for $749.

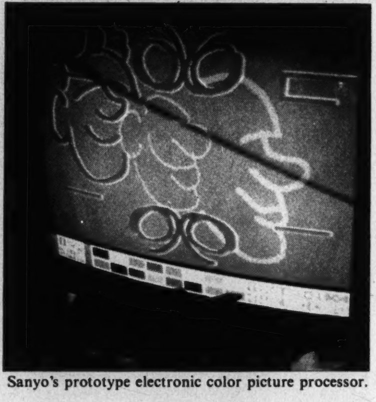
What we are not at all pleased about is seeing yet a third disk format introduced at CES by Matsushita. What this is leading to is a titanic three way battle that will almost surely see at least one format dropped or brought into compatibility with another. So far the contenders are: the Phillips system (being marketed by Magnavox and Pioneer); the RCA system, which provides actual physical contact between the stylus and rapidly rotating disk but promises a lower player price in the $500 range; and Matsushita, with its DHD system which will be marketed in the US by Panasonic and Quasar. No matter how you cut it, this means that entire market will develop somewhat more slowly than if all the manufacturers had agreed early upon a single standard.



Radofin of London and Hong Kong was showing an operational Viewdata decoder which was connected by an overseas telephone circuit to the data bank in England. This system is essentially a multi-purpose controller which allows the recovery of data from a video signal broadcast over standard or cable broadcast waves, storage of it in a cassette recorder, floppy disk or processing of it by microprocessor with input from a keyboard or modem and output to other subsystems, a display printer or telephone modem.

Radofin Viewdata decoder unit.

Sanyo was showing a prototype electronic color picture processor. This device premits handwriting in sixteen colors on a large CRT screen using a light pen in combination with a TV and microcomputer. The system had sixteen color selections, resolution of 512 points horizontally and 192 vertically. Three different paint brushes varying from 2 pixels in width to 32 pixels in width are possible. The microprocessor is an 8085 with 384K bits of video memory. The display was a 26 inch color TV set. The entire unit responded at a considerably much higher rate of speed than we are used to seeing on this type of device. Virtually as fast as you could draw the figure, be it intricate or simple, it appeared on the TV screen. Sanyo is not marketing this device at present and it looks to be one to two years away from the commercial market. ☐



Sanyo's prototype electronic color picture processor.

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CIRCLE 147 ON READER SERVICE CARD

Another View...

Consumer Electronics Show

Betsy Staples

Alvin Toffler.

Talking computers, pocket computers, pocket stereo, mini components, macro radios and Alvin Toffler were some of the memorable elements of the Consumer Electronics Show in June.

As usual, the sights and sounds of the exhibits on the show floor were overwhelming. As we made our way systematically through the booths — up one aisle and down the next — we took note of the several new products of interest to personal computing enthusiasts from APF's disk drives for the Imagination Machine to the Panasonic pocket computer and the modem which turns the Lexicon LK-3000 language translator into a terminal to the tiny Sinclair computer from England.

Atari Presents Toffler

Sunday evening we were guests of Atari at a lovely reception in the Drake Hotel. Following a presentation describing the Atari line of computers, video games and software, the hosts for the evening announced that there would be a Space Invaders tournament held after the presentation. They promised prizes for both the high and low scorers.

The winner was a video game buff who achieved a moderately impressive score somewhere in the 1600's. The low scorer was none other than a representative from Creative Computing. My 12 was completely legitimate, and I'm still waiting for my roll of quarters to be delivered.

The high point of the evening, however, was an address by Alvin Toffler. He spoke for over an hour, reiterating the points from his latest book, *The Third Wave,* which he felt were of greatest interest to those involved with personal computing.

He first explained his concept of "demassification." The Industrial Revolution, he says, produced "the second great wave of change" by creating a society based on mass production — mass consumption, mass education, mass entertainment and mass communication. "Today we are seeing a fantastic change of direction away from the mass society produced by the second wave of change to a demassified society created by a third great wave of historic change." He provided several supporting examples, including the decline of the nuclear family and the coming in its place of "new family systems in which there are childless couples, people living solo, single parent types and a whole wide variety of other structures."

Toffler views television, video games and home computers as the "beginning of a shift toward an active involvement with the screen rather than a passive involvement; and all of this is but a step toward the emergence of an 'electronic cottage.' The future convergence of video, computing and telecommunications will lead not merely to entertainment, but directly into work. We will see an increasing shift of work into the home."

The fact that most people in the American work force today are involved in manipulating symbols rather than producing physical goods, and the high cost of gasoline, Toffler feels, will combine to create "strong economic pressures to move a certain amount of work out of the factory/office and into the home." He believes "we will see homes in which husbands and wives work together — homes in which children may be drawn into the work process," in which old people could contribute to the productivity of society.

Toffler suggests that the country set a goal for 1990 to see 20% of all jobs in the home and a reduction by 20% simultaneously "of all the pollution, waste, misery and energy use built into the old and no longer viable system — a small and realizable goal with, in fact, revolutionary potential for this society. Such a change," he promises, "would help us humanize America as we go into the third wave of civilization."

Take a Computer to Atlantic City

Our second evening's entertainment was provided not by a famous author, but by an almost equally loquacious computer. Ohio Scientific invited us to meet the new C8P HD home and personal computer system. In addition to its ability to control lights and appliances in the home, monitor security and detect fire, smoke and water in the basement, the C8P HD can play Blackjack and edit letters via spoken commands.

Using a hard disk to store the phonetic representations of 3500 common short English words, the system can also reference an algorithm first developed by the U.S. Naval Labs for the phonetic generation of longer words by rules. Thus, it can pronounce any word in the English language in real time from its conventional spelling. Being from Ohio, however, it tends to favor midwestern pronunciations.

The computer can also recognize words spoken by the user. It must first be trained using a method similar to the popular audio-lingual method of foreign language teaching: the user repeats into the microphone, a minimum of three times, the word he or she wants the computer to recognize. The machine can be trained to recognize up to 100 distinct words in this manner.

In the Blackjack program, the player may place a bet by speaking into the microphone, then, after examining his cards, tell the computer/dealer that he wants to "stay," or be dealt another card — "hit." At the end of the hand, the C8P HD announces the score and asks if the player wants to try again.

Small is Smarter

In one of the most important non-computer-related products represented at CES, there appeared to be two contradictory trends evolving. Almost all of the manufacturers of stereo equipment were showing "mini" or "micro" components — some just miniatures for inconspicuous home use, others complete, portable systems that were no bigger than a breadbox, including speakers.

On the other hand, there were also many new, larger amplifiers and speakers capable of handling upwards of 100 watts per channel. "Whatever for?" we wondered. "More noise pollution," we decided.

In keeping with the trend toward tinyness, were several pocket-sized radios attached to tiny, lightweight stereo headphones. Would that more people would take advantage of this opportunity to protect their own privacy and that of others rather than derive their entertainment from the monstrous "portable" radios (also on display in profusion) that have begun to appear everywhere to assault the ears of even the most enthusiastic music lover. □

Reaching Towards Tomorrow

Tales of the Marvelous Machine:

35 Stories of Computing

A robot friend. A computer God. Artificial intelligence challenging human intelligence in a life and death struggle. A detective solving a computer murder. Computers tricking people or people tricking people with computers. A computer with a soul. Or power. A lonely computer. Or one in love with its operator.

In thirty-five wonderful stories about computers, authors such as Frederick Pohl, Charles Mosmann, M.V. Mathews, Carol Cail, and George Chesbro depict a life in which computers affect the way people live, think, and relate to each other. Interested in what the effect of computer saturation might be? Only fiction can so wonderously dramatize future life.

The book is fun, and will provide wonderful hours of entertainment. For the reader interested in a structured approach to understanding the potential roles of the computer, or wanting quickly to locate stories that support or challenge his viewpoint, a multiple table of contents is provided. This lists the stories in fourteen different categories.

For example, a list of stories in which the computer takes on the attributes of a human separates them from those in which the computer is only an intelligent machine. The stories are categorized by whether they clarify, improve, or worsen the human lot. Stories in which the computers have capabilities available today are separated from those in which the capabilities could be available in the future. There is a listing of the wildly whimsical stories and those in which the computer is utilized in a unique fashion.

Can criminals be caught by computer? Does computer crime pay? Do computers fall in love? Are we all part of a larger organic computer? Here are 35 tantalizing tales that will open your eyes to a new perspective of computers.

Skillfully drawn illustrations augment the stories, giving glimpses of scenes as envisioned by 20 talented artists. This artwork adds another dimension to the text.

Tales of the Marvelous Machine: 35 Stories of Computing, edited by Robert Taylor and Burchenal Green, is a beautiful big 8½" × 11" softbound anthology of 272 pages.

It is available for $7.95 plus $2.00 shipping and handling per order from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add 5% sales tax. Visa, MasterCard and American Express orders are welcome. For faster service, call in your bank card order toll free to **800-631-8112** (in NJ call 201-540-0445). Or use the handy order form bound into this magazine.

CIRCLE 350 ON READER SERVICE CARD

creative computing press

Where are they now?

Bally, Interact and VideoBrain

David H. Ahl

Three computers were introduced in late 1977 that were truly aimed at the consumer market, the Bally Arcade, Interact Models 1 to 4 and VideoBrain. All were capable little machines but none quite made it in the marketplace. The reasons are many — distribution, dealer training, advertising, limited software, etc.

Today, however, we continue to get letters from owners of these systems looking for documentation, software, other users and help in general. Here's what we know. It isn't everything. We'd be happy to have some of the missing pieces filled in by readers.

Bally

The Bally Arcade, renamed later the Bally Computer, was originally sold by JS&A. It was plagued at the beginning with severe delivery delays and lack of support. Eventually Bally got their act together and started delivering reliable machines.

Unfortunately, about this same time Bally was hit with some major cash requirements for construction of their casino in Atlantic City among other things. As a result, Bally decided to sell the computer division to Fidelity Electronics (makers of Chess Challenger and other high-end electronic games). Many Bally distributors and dealers were opposed because Fidelity had a reputation for dealing direct instead of using distributors and dealers. Consequently, a group of distributors got together and made a counter offer.

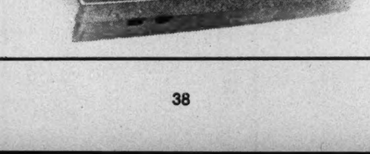
The net result was that neither deal was consummated and Bally decided to reactivate the computer division themselves. At the 1980 Summer CES, Bally was showing the basic computer with several new ROM cartridges of games. The old cassette interface never worked reliably — we had three and never were able to read programs from other systems. It is to be hoped that the current model has the bugs out. Without it, of course, there is no way to exchange programs except by means of typed or handwritten listings.

A Bally club was active for about a year, but is not active now as far as we can determine.

We are glad to see Bally back in the market since they produce a very nice machine with lots of graphics and sound goodies at a very attractive price ($299.95). For more information, contact S-W Distributors, Inc., 5300 B McDermott Drive, Berkeley, IL 60163. (312) 449-5000.

Interact

A few short months after going into production with three new models, Interact bit the dust. We found the Interact to be a capable machine with 16K memory, cassette drive, color graphics and sound built-in. We understand that many dealers are selling systems today with deep discounts from the $549 (and up) list price.



There is an active Interact owners group with a regular newsletter. Membership is $10.00. For a sample newsletter send a 15¢ stamp to INTERACTION, Detroit Interact Group, 15356 Prevost, Detroit, MI 48227.

VideoBrain

Perhaps the most innovative of the three machines with its APL/S language, VideoBrain failed the most decisively. VideoBrain computers are currently being remaindered at $150 and less. For the hardware, this is a real bargain; however, virtually no technical documentation is available as far as we can determine. Nor are there any active clubs which focus on VideoBrain.

VideoBrain had perhaps the finest joysticks in the industry. These are being sold today under the name VideoStik for around $40 a pair.

If anyone has any further information about these or other similar companies, we'd be happy to hear from you. ☐

THOUSANDS OF COMPUTERS ARE GATHERING IN CHICAGO.

The biggest and best computer show ever to be in the Chicago area is ready to take place. Make sure you take it in.

Over $50 million worth of software and hardware for business, government, home and personal use will be featured at the new Mid-West Computer Show in October. Computers from $150 to $250,000, mini and micro computers, data- and word-processing equipment, telecommunications, office machines, peripheral equipment and services will all be on display and for sale right on the spot.

All the major names like IBM, Xerox, Radio Shack and Apple will be there. There will be conferences on business uses of small to medium sized computers, and how to make purchasing evaluations.

Plus, robots, computerized video games, computer art and computer music will entertain and educate kids, spouses and people who don't know a program from a memory disk.

It's going to be a great show for everyone.

Admission for adults is only $5. The public is invited, and no pre-registration is necessary.

Don't miss the coming of the computers. Show up for the show.

CHICAGO
McCORMICK PLACE, THURSDAY-SUNDAY, OCTOBER 16-19
11 A.M. TO 9 P.M. THURS.-SAT., 11 A.M. TO 5 P.M. SUN.

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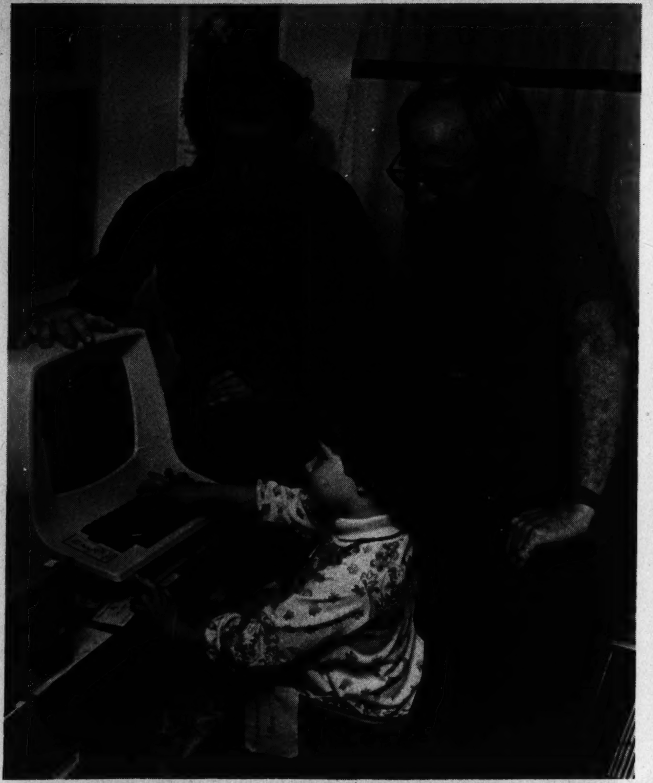
Produced by National Computer Shows, 824 Boylston Street, Chestnut Hill, MA 02167, Telephone (617) 739-2000.

The World Inside The Computer

S. Frederick D'Ignazio



Stan Gilliam (left) and Fred D'Ignazio (right) watch Fred's four-year-old daughter, Catie, type messages to *Ged*, the family's home computer. (Photo by Harold Moore, *Durham Morning Herald*.)

> *. . . if you can program your computer, here is a tiny universe in which you can be God. Within the realms of expression that the computer can provide, you can build a world, define its laws, and watch the universe unfold. As your whim dictates, you can intervene at any time and, if you desire, the history of your universe can be changed or rewritten at will. Such a paper this is!**

Kids use personal computers to play games. What are these games? Often, they are *simulations* or *models*. In creating computer games, kids are learning to build miniature replicas of the universe — models of the real world and worlds of fantasy woven from the threads of pure imagination. As personal-computer technology evolves, and as the child becomes a more knowledgeable and sophisticated model-builder, his or her models will become increasingly lifelife, dramatic and enchanting. Volcanoes will roar, thunder and belch black plumes of ash and smoke. Fire-breathing dragons will appear unexpectedly along dark and slimy, maze-like corridors. Heroes and heroines will arrive on the scene, accompanied by the child's personally composed epic music.

Consider for a moment, the youngest children — the preschoolers and the primary-school kids. These children are to be envied. Their inquisitive minds, their natural inventiveness, and their unbridled imaginations are perfectly suited for the personal-computer devices — "the mind tools" — that lie just around the corner.

The question arises: "How should we introduce the computer to these kids?" Certainly we should abandon the approach followed in the past. At that time computers were often pictured as rows of boxes connected by skinny lines and arrows. To the young child the computer was a curious hodgepodge of *memory* boxes, *processor* boxes, *input* boxes, and *output* boxes.

As the child becomes a more knowledgeable and sophisticated model-builder, his or her models will become increasingly lifelike, dramatic and enchanting.

Then, with theory out of the way, the child was shown pictures of a real computer: stark, black-and-white photographs of hulking, whooshing tape drives, squat card readers laden with stacks of punch cards, and huge switchboard panels teeming with tiny blinking lights. And who did the child see working with these machines? Solemn, silent people servicing the machines, feeding them and communicating with them. Everyone was well-dressed. It was a lot like church.

Obviously, a new approach is needed to introduce the new, personal computers to the youngest children. Of course, within only a few years, this will cease to be an issue at all. Then, home computers will be so common, that even the youngest child will first learn about computers by watching his or her mom and dad or older brother or sister. Shortly after, she, too, will be talking and listening to the computer, making it play musical tones, and painting pretty pictures on the computer screen with her light "brush."

But for now, an alternative approach is needed. One method has been recently tried and been proven effective, and I'd like to briefly describe it to you. This method consists of introducing computers to young children using my picturebook, *Katie and the Computer*. The book is a fantasy adventure story, but one with an important twist: each episode in the story parallels the functions of a real computer as it processes a real program. The program itself isn't an "adult" program, producing business-like and adult results. Instead it is a *FLOWER* program that produces something interesting for the child: a pretty picture and an attention-grabbing sound.

Introducing computers to children via an adventure story accomplishes many objectives. First, it captures children's

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*Gregory Yob, "The Computer as a Gun: Personal Computers and Personal Autonomy," *NCC '79 Personal Computing Proceedings*, New York: American Federation of Information Processing Societies (AFIPS), p.9, 1979.

S. Frederick D'Ignazio, 730 Williams Circle, Chapel Hill, NC 27514.

interest. And, in becoming interested, the children identify with and become personally involved with the adventures of the heroine in the story as she journeys through the computer. Second, it establishes an important connection between computers and drama, color, imagination, action and excitement. And last, unobtrusively, yet deeply and effectively, the adventure story familiarizes the child with the key words associated with computer components and with the major processes occurring within a computer. The components are metaphorically realized as landmarks in *Cybernia,* the world inside the computer. The processes appear as episodes in the story.

Kids, Meet Katie And The Computer!

Katie's father was waiting for her when she got out of school. He was very excited. "Katie," he said, "our computer came!"

"Oh, boy!" said Katie. "Can I play with it?"

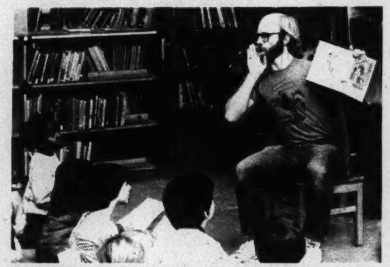
"Sure," said her father, and they rushed home.

Katie and her dad arrive home. Her dad types the word, "PARROT," on the computer, and a bright green parrot appears on the screen and says, "SQUAWWK!"

Katie wants to make something, too. Her father has her type the word, "FLOWER," to make a picture of a flower.

As Katie typed "flower," she leaned closer and closer and closer to the picture screen. Then she lost her balance and fell forward. But instead of bumping her nose on the glass, she went right through it and began spinning and falling, just as if she'd tumbled off the top of a tall mountain.

So begins Katie's adventure with her magical computer. On her whirlwind trip through the world of *Cybernia* inside the computer, Katie bobsleds down the vertical face of a mountain, parachutes from an airplane, slides down a slippery brass pole, gets fired from a cannon, and



Fred tells the story of *Katie and the Computer* to children at the Estes Elementary School in Chapel Hill, North Carolina. Here he plays the part of the software Colonel as he, Katie and the Flower Bytes bobsled down a snow-covered mountain inside the computer. "Let's go now!" hollers the Colonel. "We're overdue at the CPU!" (Photo: Danny Moore, *Chapel Hill Newspaper.)*

The Origin Of Katie & The Computer

Catie's nose banged into the computer picture screen. "WAAHHH!" she howled.

I leaned forward, grabbed her under the arms, and took her into the kitchen to her mother. "She's done it again," I complained. "Bounced forward on my lap, right into the computer. She keeps this up, and she's going to break her nose on the screen."

"Or maybe go right through," my wife mused.

"Go right through!? And get tangled up in wires or get a blast from a hot cathode?"

"Not at all," Janet said, smiling. She wiped away our daughter's tears. "Catie wouldn't find wires or cathodes. She'd find adventure and zany characters, just like Alice did when she fell down the rabbit hole into Wonderland. Only this wouldn't just be a "land," it would be a whole world, a world inside the computer."

Janet loves children's books. It was just like her, taking something complicated and technical, like a computer, and turning it into a fairy tale. "But once Catie fell into the computer, how would she get out?" I asked.

"You're so anxious to write a children's book," Janet said. "Here's your chance. Write about Catie's adventures in the world inside the computer, and use those adventures to teach little kids how a computer really works."

"But I still don't know how she gets out," I said. I imagined a bizarre scene in which Janet and I used cranes and pulleys to rescue two-year-old Catie from the electronic bowels of the computer.

"You'll think of something," she said.

And she was right. We were on the interstate just outside South Hill, Virginia, in the middle of a long trip back from Pennsylvania. Caught between the monotonous boredom of the road and hyped up on coffee, I began seeing an animated cartoon of "Catie and the Computer" right inside my head.

I pulled off the road and drove up to a Pizza Hut. "I'm starving," I said. "And, besides, I've got to write this down."

Without explaining, I hopped out of the car and dashed into the restaurant. When Janet and Catie walked in, a moment later, I had already accumulated a stack of paper napkins, and I was busily scribbling — blotting blue marker and tearing the paper, but capturing the story as it flowed from my brain.

When we left the restaurant, I carried my precious napkins with me in a tight little wad. We finished our drive back home to Chapel Hill. The next day I called my friend Stan Gilliam, a local artist. Stan and I had gotten together several times trying to figure out a kid's picturebook we might collaborate on. "I think I've got an idea," I told Stan. I rushed out to his place, a tiny log cabin, nestled against a forested hillside south of town.

When I got to Stan's I began telling him the story. I stood up, paced around the room, and gestured wildly as I talked. We both became excited. Stan reached for his drawing pad. Swiftly, nimbly, he began sketching scenes from the book as I described them. "Here's the Colonel," he said, "and Catie, and the mean and awful Bug."

I had never worked with an artist before. I couldn't believe my eyes. It was like magic. My words were being turned into pictures, even as I talked. This is going to work, I thought. We've got ourselves a book!

Well, not quite. First, I had to write the words down. (Up until then, all I had were scribbled notes on an untidy stack of Pizza Hut napkins.) Second, Stan and I began endlessly revising the pictures and the words, to get them to work together harmoniously and dramatically.

We attended an evening course on children's literature and presented our story to the class on its final meeting. I told the story in spite of a bad case of laryngitis. And a sudden downpour threatened to wash away Stan's watercolor illustrations as he pulled them out of the trunk of his car and made a frantic dash to our instructor's front porch.

While we revised our words and pictures and attended our course, Stan and I conducted a literature search for other children's picturebooks about computers. After an exhaustive search, we only managed to turn up two titles in over ten years, and both books were completely different from ours.

We began sending our proposals: to ten publishers, twenty, forty, eighty, a hundred. Finally, almost a year after the fateful visit to the South Hill Pizza Hut, and after three false starts with other publishers, we sold our book to *Creative Computing.*

Now the real work began. Stan started turning out page after page of original, full-color illustrations. Meanwhile, with guidance and help from Burchenal Green, our editor at *Creative,* I revised my manuscript another dozen times. I cut out the story's voluminous descriptive passages and relied on Stan's pictures to visually convey each scene. I had to throw out most of my big words in order to make it possible for a second or third grader to read the book herself. And there was the balance to strike between the book's two main goals: *entertainment* and *education.* I had to walk a swaying tightrope and make the episodes metaphorically parallel the functions of a real computer yet keep them action-oriented, dramatic and exciting.

World, cont'd...

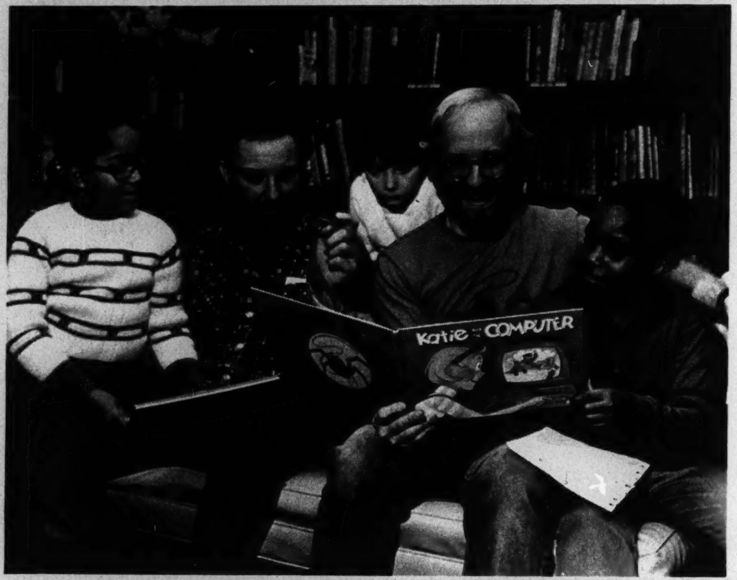
comes face to face with a monster robot spider.

She also meets a variety of characters in Cybernia. There's a fiery *Colonel,* "a curious-looking man in a fancy soldier's uniform." There are the *Flower Bytes,* each with a letter from "flower" painted on his or her uniform. There is the *Table Manager,* "a frail, frazzled looking man with fists full of paper scraps." There are the *Flower Painters* "who grab buckets of gleaming paint" and who "move like whirlwinds." And there is the "mean and tricky" program *Bug,* perhaps the most memorable character of them all.

What does Katie do inside the computer? She tries to get the computer to paint a picture of a flower. Is she successful? Does the flower get painted? Does Katie escape from Cybernia and return to the real world?

Over four thousand children have "met" Katie and the computer, and have heard me tell the story through to its climactic conslusion. The kids' ages range from 3 to 11. I've told the story at a day care and at a dozen elementary schools. Over time I've developed three different approaches to telling the story, depending upon the age or grade-level of the children.

Finally, the story and illustrations were ready. At the last minute, we changed the name of our herone from "Catie" to "Katie," to avoid mispronunciation. We persuaded our editor, Ms. Green, to retain the story's villain, the Bug, who we felt, though scary and evil, was a dramatic highpoint of the book, and still (on many occasions) metaphorically accurate. We suffered through endless delays with the book's printer and binder. But the book was finally ready. On December 20, 1979, on Catie's fourth birthday, she and I drove up to New York City and jointly autographed the first copy of *Katie and the Computer.*



Stan and Fred reading their picturebook, *Katie and the Computer,* to children at the R.N. Harris Elementary School in Durham, North Carolina. When they appear together, Fred usually tells the story and talks about computers, while Stan describes some of the techniques he used to create the book's lively, full-color illustrations. (Photo courtesy of the *Durham Sun.*)

Inside The Computer It Was Snowing

With the youngest kids (the kids at the day care and the five- and six-year-olds), I concentrate on the story as an *adventure* rather than as a *technological metaphor.* I tell the story on my feet, acting out the parts and adopting voices for each of the characters. For example, when the Table Manager talks, he has a quivering, squeaky falsetto. But when the huge and horrible Bug appears, my voice deepens into a gravelly, threatening roar.

Who did the child see working with these machines? Solemn, silent people servicing them. It was a lot like church.

As I talk, I pace back and forth in front of the kids, waving my arms, leaning from side to side. I try to dramatize each of the story's major episodes. In one episode, the Colonel smacks the Table Manager with the flat part of his sword to get the Table Manager's attention. In expressive pantomime, my arm and my imaginary sword arc high in the air, then swoop down. My hand loudly slaps the back cover of the book, giving the Table Manager a resounding "SMACK!" on the bottom.

Later in the story, Katie and the Flower Painters hop aboard a Cybernian Bus and leave RAM Tower, the Flower Painters' home. Just as the bus begins rolling, the Colonel arrives and makes a giant leap onto the bus' tail end. Playing the part of the Colonel, I back up, then run forward and jump high into the air. I close my eyes and make believe I'm Mikhail Baryshnikov hurtling gracefully across an opera stage. But like the Colonel landing on the bus, I come crashing down onto the schoolroom floor, puff noisily and holler, "Head to the CPU, then on to the Tube for some fireworks!"

As I'm telling the story, I punctuate it with numerous sound effects, just like those in the book. Katie lands "FLUMPFF!!" in a bank of feathery snow. The Flower Bytes' bobsled pulls up in front of the CPU with a "SHHHUUUUPPP!" And the cannons roar "BOOOM!! BAROOOM!! BOOOM!!" as they "belch colorful clouds of fire and smoke into the night-time sky."

Also, I try to get the children to participate in the story as much as possible. For example, I point to illustrations in the book, and have the kids call out: "R-O-M!!" "C-P-U!!" and "R-A-M!!" As Katie races through her adventures, I have the kids constantly spelling out "flower." And when I reach the part of the story where the Flower Bytes line up in the CPU and call out their letters to the Table Manager, I get six eager volunteers to stand up, stick out their chests, hold their heads high, and yell out their letters: "F!" "L!" "O!" "W!" "E!" "R!"

At the end of the story (which takes around twenty minutes to tell), I pop out of the fantasy and remind the children that Katie's computer wasn't real, it was magic. But I make it clear that real computers are *almost* magic. I tell the kids about integrated circuits that keep getting smaller and smaller. I talk about whole computers that fit inside a paper clip, million-byte bubble memories smaller than a kid's thumbnail. I talk about the computer's amazing speed — how it can do thousands, millions and someday billions of things in a single second. Then I answer the kids' questions and make sure to get the kids talking about what computers mean to *them.*

The parts of the book that I use with this youngest group are the story itself, of course, and the magnified image of the computer chip that appears at the end of the book. Also, I tell the kids that a real computer doesn't have little people running about; that, instead, the computer is powered by tiny bursts of electricity zipping about at a fantastic speed. I show the kids the page that says, "MEET THE FLOWER BYTES." Pointing to the Flower Bytes, I tell the kids that each byte is made up of charges of electricity, whizzing single file along the computer's wires. I remind the kids how the bytes themselves, all in a row, bobsledded down the mountain to the CPU.

Half Magic

The next group of kids are the seven- and eight-year-olds, kids who are in the second and third grade. From experience, I've learned that the book's fact and fantasy mix together just right for these kids. They're at the tail end of the picturebook age, and they still have a great appreciation for magic and fantasy. Yet they are old enough to understand the computer concepts introduced in the book.

I enjoy telling this group about some of the applications for small computers, including robots, computer music and computer "paintbrushes." We talk about such things as computer *animations, movies* and *cartoons.* I ask the kids what kinds of movies and cartoons they might create, what kinds of sound effects they might use. We talk about composing theme music and creating computer graphics for computer games, and about animating characters on the video "stage." On occasion, Stan has appeared and enriched this discussion with the ideas and techniques he used to illustrate *Katie and the Computer*.

With this group, too, I begin by telling the story, complete with characters' voices, bounds, leaps and frantic arm waving. Also, I often bring along a small computer, like a *PET* or an *Apple II.* After I tell the story, I open the computer up to show the kids the electronics inside. But there is a problem. The element of fantasy becomes so real for these kids, that when they crowd around the computer, they want to know where the characters from the story are — *especially the Bug!* "Let's see the robot spider!" they cry. "Where does he live?"

Fred telling the story of *Katie and the Computer* to kids at the Victory Village Day Care in Chapel Hill, North Carolina. Katie, the Colonel and the Flower Bytes have just entered the CPU and are trying to locate the address of the Flower Painters who live in RAM Tower. Playing the part of the Colonel, Fred smacks the address Table Manager on the bottom with the flat part of the sword to get his attention. (Photo by Chip Hoover.)

So I've developed a response, a way to make a clean break between the real and fantasy sides of the book. Now, as soon as I've read the story, I walk over to a table and grab a chair. "You have just heard a story about Katie's magic computer," I begin. "If you want to see a real computer, go to a shopping mall and visit a Radio Shack. Radio Shack stores have a computer known as the TRS-80.

"Let's pretend that I'm in a Radio Shack right now." I point to an empty spot right in front of the chair. "Let's say I've just entered a Radio Shack and walked over to a TRS-80 computer sitting in front of this chair. Say I've read the story of *Katie and the Computer,* and I want to be like Katie and somehow get into Cybernia, the magic world inside the computer.

"I look all around. I want to be sure no one is watching. Good. The coast is clear. Real quietly, I step up onto the chair. Then, before anyone can stop me, I fold my hands together, and, like the Table Manager in the book, I dive like an eagle — right into the TRS-80 computer!"

One of the most popular parts of the presentation deals with computer-controlled robots. Kids love them!

In the classroom or library, with the kids' mouths wide open and the teachers looking amused or perplexed, I crouch down low on the chair, then spring high into the air, and come crashing to the floor with a loud "THUMMPP!!"

I run over to the kids, eyes squinting, a serious look on my face, and ask, "If I really did dive into a computer, would I r-e-a-l-l-y fall inside, just like Katie?"

Usually, I've looked so absurd and ridiculous that the kids' sense of realism takes over, and they all cry, "Noooooo!"

"What would *really* happen?" I ask.

"You'd crash into the glass!"

"You'd break the computer!"

"You'd get all tangled up in the wires!"

One third grader, blessed with a vivid imagination, had a more elaborate answer: "You'd fall into the computer, but you'd blow up and be splattered all over and be all around. And then you'd be electrocuted!"

Fred tells Katie's story again at Victory Village. He plays the part of the Colonel, and the kids pretend to be Flower Bytes. (Photo by Chip Hoover.)

After that one, I had little worry about some gullible kid trying to mimic Katie and jump inside a real computer. At least I knew *I'd* never try it.

Binary Numbers, Adventure Games and Robots

When I tell the story, the most charming kids are the ones in the first two groups. They get thoroughly wrapped up in the fantasy, yet, with a little prompting, they easily make the leap back to the world of real computers.

When I talk to the third group, the kids nine years old and older, things are different. These kids are past the picturebook age, and they look at picturebooks as babyish and beneath them. Also, they're more skeptical than the younger kids and more likely to resist the strong element of fantasy in the story.

The real pleasure I get with the older kids comes after the story is finished. Then I can use the entire book as it is meant to be used: as a teaching aid. I use the factual section at the end of the book to teach the kids about computer *hardware* and *software.* I use the "Pictorial Outline" in the front of the book to show the kids how a real computer would process a "FLOWER" program and display a color image of a flower on the picture screen. And I teach the kids about *binary numbers* and *computer translation* with a scene where the computer's operating system, pictured as the blustery, imperious Colonel, summons the Flower Bytes:

> *"This is where the Bytes live," the Colonel said. "Each Byte has a letter or number that's all his own." The Colonel reached for his bugle. "I use this to summon the Flower Bytes," he explained. "It only plays two notes, but I*

World, cont'd...

can arrange them into a special song for each Byte. Listen, and you'll see."

"BLEEETT!" burped the bugle. "BLAATT! BLEEETT! BLEEETT! BLEEETT! BLAATT! BLAATT! BLEEETT!"

I flip to the page called "MEET THE FLOWER BYTES." As the book does, I tell the kids about high and low electric charges and how a "BLATT!" from the Colonel's bugle means a high charge or a *one,* and a "BLEEETT!! means a low charge or a *zero.* I stand at attention, like the Colonel, and begin loudly blowing my imaginary bugle. I play a special song for each Flower Byte. At the end of each song, I get the kids to use the *ASCII* table in the book (illustrated with cartoon pictures of each Byte), and tell me which Byte's song I just played.

I especially like telling the older kids about *adventure* games. We get into a discussion of model-building and simulation — of real worlds and worlds of fantasy. When I have time, I mix computers and creative writing. First, I have each child write up the script for a simple adventure game. Second, we read the scripts out loud. Last, we discuss how the games might be implemented on the computer, and we try to come up with enhancements to make the games more exciting.

One of the most popular parts of my presentation deals with computer-controlled robots. Kids love them! A lot of articles have recently appeared in kids' periodicals about young inventors who are building robots in their folks' basement workshops, in their bedrooms, even in their apartment-house kitchens.

At the beginning of the discussion, I make up an imaginary robot whom I call *Humphrey.* Humphrey looks like a cross between a lawn mower and a garbage disposal, but he's a lot smarter: he can beat me at backgammon and chess, he's great at bluffing, and he has an endless repertoire of wisecracks and one-liners.

Instead of little people running about, the computer is powered by tiny bursts of electricity zipping about at a fantastic speed.

What's more, he's pretty silly. And using Humphrey's silliness to lighten the discussion, I introduce several basic computer concepts and techniques, including *programs, bugs, loops* and *recursion.* For example, I turn to the page in the book where the Bug lassoes Katie and the Colonel's yellow airplane with his sticky bubblegum rope. Katie and the Colonel hang on for dear life as the monster swings their little plane round and round in a loop, "like a merry-go-round gone crazy."

I tell the kids about bugs and loops in real computer programs, then I describe a short *LOGO Turtle* program:*

```
TO LOOP :SIDE :ANGLE

10 FORWARD :SIDE
20 RIGHT :ANGLE
30 LOOP :SIDE :ANGLE

END
```

Together, the kids and I work through the program and "discover" that it makes Humphrey go around in a circle (or loop). We talk about how the program works and about loops and recursion. Then I play the part of Humphrey executing the program — with input values of 10 centimeters for SIDE and 15 degrees for ANGLE. I goose-step swiftly through one loop, then another, and another, and another. After awhile I become so dizzy and uncoordinated that I collapse in a heap in front of the giggling teachers and kids.

Again at Victory Village Day Care. Here Katie and the Colonel fly a little yellow airplane to RAM Tower to meet the Flower Painters. Unknown to either one, the mean and tricky program Bug lurks around the corner. (Photo by Chip Hoover.)

In talking about programming, I like to touch on the computer's literal-mindedness: How a computer only does what you tell it — nothing more and nothing less. How you may not know exactly what you told it. And how this produces results that are sometimes humorous, sometimes alarming, but always unpredictable.

I talk about bugs and how they creep into programs unexpectedly. I illustrate this problem with another performance from Humphrey. This time Humphrey's mischievous young inventor programs him to play a prank on his big sister. Humphrey is to go barging through the bathroom door, unannounced and uninvited, and surprise the kid's big sister in the middle of her bubble bath.

Unfortunately for the kid (and his big sister), there is a bug in Humphrey's program. The kid told Humphrey to do only one thing: go FORWARD :SIDE. But he set SIDE equal to four meters, and it is only 3½ meters to the bath tub. Humphrey enters the bathroom. Accompanied by horrified shrieks from big sister, he paces forward four meters, bangs into the tub, and does a front flip, landing on big sister's lap and burying himself in pink bubbles.

I had little worry about some gullible kid trying to mimic Katie and jump inside a real computer.

I'm not sure the teachers appreciate this example, but the kids love it. It always provokes an animated discussion about robots, programs, bugs and big sisters in bathtubs.

Springboard To The Future

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*This example was inspired by *Turtle* robot "MicroWorld" programs. The programs, written in LOGO, were found in Ellen C. Hildreth, "The Creation of Design: An Exploration in Art, Mathematics, and Creativity," Cambridge, Mass.: LOGO Project, September 1977.

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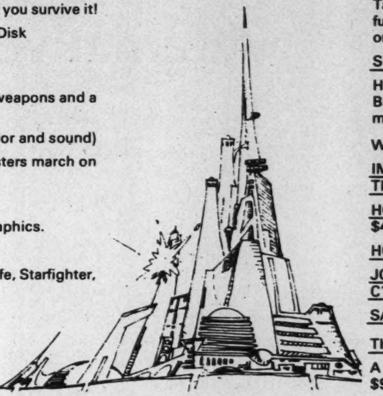

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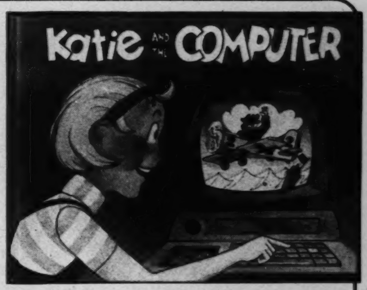

Katie and the Computer

Fred D'Ignazio and Stan Gilliam have created a delightful picture book adventure that explains how a computer works to a child. Katie "falls" into the imaginary land of Cybernia inside her Daddy's home computer. Her journey parallels the path of a simple command through the stages of processing in a computer, thus explaining the fundamentals of computer operation to 4 to 10 year olds. Supplemental explanatory information on computers, bytes, hardware and software is contained in the front and back end papers.

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The Leader

"Children might not suspect at first there's a method to all this madness—a lesson about how computers work. It does its job well."

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Infosystems

The book has received wide acclaim and rave reviews. A few comments are:

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Computers At An Alternative School

Deborah Stone

Educational uses of computers often fall into authoritarian styles of operation, but it's quite another story at a school that may have the most computers per student in the world.— TN

Photographs by Erik Nelson.

High Valley is a small private tutorial school in rural Dutchess County, New York, founded in the 1940s by Olga and Julian Smyth.

High Valley is an old farm, and our school buildings are old farm buildings. Our students have animals to take care of and a great deal of space (almost 120 acres) to explore.

The main features of High Valley which distinguish it from other schools are as apparent to the eye of the casual visitor as to those of us who know it best. It does not look like a school. An old farmhouse is our center, and the old barns and other outbuildings of the farm have been converted to form inviting classrooms.

There are only twenty students here, almost half day students, and the rest five-day boarders. Some of our students are here because they have done badly in school, some because their parents think other schools have done badly by them. The students range in age from eight to eighteen.

The staff roles are extremely fluid, especially for the four of us who live here. We all assume disparate and shifting roles as needed; each of us is available to be the special friend or port in a storm to any student, regardless of whether we are that student's assigned teacher.

The upper-middle-class orientation and style of most other private schools is lacking. Private schools tend to have a strong emphasis on conventional standards of academic achievement, while High Valley's group is so diverse that the focus instead is on the development of each pupil's potential and learning style, with achievement for each individual meeting his or her own idiosyncratic needs and abilities. This is a pervasive ethic, as can be seen in the free and understanding personal relationships between students of obviously different abilities on a conventional scale. Thus the school introduced the practice of mainstreaming long before it was fashionable or indeed had a name.

The High Valley approach to teaching is built around caring relationships and personal attention. As a community we hold a morning meeting, take meals together, and do chores around the farm. As individuals all students are given challenging work, whether they are at an advanced academic level or at a more formative, foundation-building stage. There are no grades, as these introduce meaningless standards of comparison. Our approach does not mean that things degenerate into hanging around until you find yourself. Children are less likely to find themselves through introspection than through finding honor in doing something well.

Our contact with computers began casually. One of the boys' fathers brought, at different times, Sol and Sorcerer computers for the kids to play with. Response was enthusiastic. "Lunar Lander" on the Sol was a popular program, and one of the kids found out how to make it harder or easier. Some were especially interested in the graphics, and one boy invented lovely patterns in very much the same way he liked to noodle around with music on the piano or guitar. We could see in all this the kind of independent, mischievous thinking that we are always so glad to encourage in our students.

Games were the first things that the kids tried on the computer. They gave us an immediate sense of the computer's approachability.

Though getting our own computer seemed to be the thing to do, we circled around the decision for a long time. With the help and advice of a few parents, and the kids who had been most involved, we narrowed our choices down to the Apple, the Sorcerer and the Radio Shack TRS-80.

After mulling it over we chose the Apple, for the completeness of its package, its high-level facilities, and its legendary reliability. The original purchase (in February '79) was a 16K Apple II without disk, to be used with cassette storage and a black-and-white TV. Contributions from a number of enthusiastic parents helped make the purchase possible. Since that time it has been upgraded to 32K, with a disk and color TV. Our next step will be to get the full 48K of memory and a printer.

We have been very happy with the

Deborah Stone, High Valley, Clinton Corners, NY 12514.

choice. One repair was needed after a year and a half — we think that's pretty good. (A friend of the school later gave us a TRS-80. This unit is underutilized, partly because we don't have a disk drive for it yet. As a result, however, our two computers give us a computer-to-student ratio of one to ten — a rather high figure, we understand.)

Due to the delicacy of the equipment, we have had to exercise some caution about access to the machine. Our computer center is a lockable room (shared with our photographic darkroom equipment); some of the students have permission to go there alone and some must go in the company of others.

One of the charms of the situation has been that the faculty knew absolutely nothing about the computer, and weren't even too interested. Aside from the one parent who got us started, who would drop by every few weeks and ask how it was going and give the kids pointers, teaching about the machine has by default,been left to the students who understood it; the kids have been free to do it on their own. They had no guidelines from us about what you're supposed to do with a computer, because we didn't *know.*

Many kids who don't do well in school are secret computer geniuses, because there nobody is telling them what to do.

Games were the first things that the kids tried on the computer. They loved Breakout, which came with the original cassette configuration. As a game, it gave us an immediate sense of the computer's approachability. It also provided a gradual transition to more serious use and understanding of the computer. Creating modified versions of Breakout by changes in the program created much enthusiasm, and provided indirect programming insights to students who were not yet interested in learning to program. The "Animals" game, which is supplied with the disk system, has also been very popular among students at all levels.

The Animals game is a simplified data-base system which gives considerable insight into the nature of stored information. The program tries to guess what animal the player is thinking of, by asking about the animal's traits in a "twenty questions" yes-or-no format. If the animal you are thinking of is not yet in the data base, the computer asks you how to distinguish that animal from the one it already has stored which is most nearly like it. Your present animal is then stored along with all the rest, and thus joins the computer's repertory.

The thing that's interesting about Animals as played at High Valley is that some kids put wrong information in it inadvertently. Confusion has arisen over the question "Does it give milk?" which for some kids signifies Cows, for others Mammals, and by others is seen as excluding males. Thus a large and somewhat inconsistent data base has evolved which I suppose has educational value even in its inaccuracies.

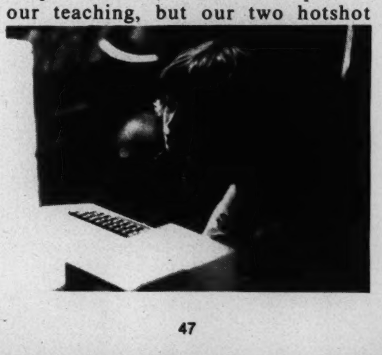
Some kids played Star Wars and Breakout until they were able to knock down all the bricks, then lost interest entirely. But always there have been others who are interested in working with the computer.

They have had all kinds of different reasons. One wanted to hang out with our two experts. Another had an older brother who was involved with computers. Two other boys enjoyed learning programming.

Several of the students have written their own programs. Two of them have become real pros. (One boy has already bought his own Apple computer, with his parents' help, and has found work as a professional computer programmer and consultant in addition to his high school studies.) Another student has begun saving for an Apple.

Our computer has turned out to be like everything else around here that we use — it figures in our personal relationships and our learning experience. For instance, one boy wrote a story in which the computer came alive and spoke to him when he was trying to play Breakout. In response to his story, one of our experts programmed the computer so that the next time the boy went to play Breakout, the computer greeted him with exactly the words he himself had written in the story. He loved it.

Having the kids teach themselves and each other has in general worked out very well. There has been no formal attempt on the part of the staff to use the computer in our teaching, but our two hotshot programmers did make some teaching programs for fellow students who were having trouble understanding fractions.



However, the arrangement has left something to be desired in terms of the amount communicated to the students who don't put themselves out to learn about it. For our first year and a half of experience, however, we are very pleased.

How It Fits In

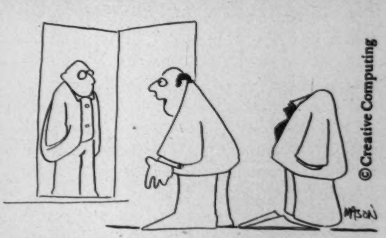
The way we work with our children is based on a humane respect for children's dignity and worth, and an awareness of and readiness to meet children's emotional needs.

I am beginning to suspect that while having learning difficulties in regular school may reveal weakness, vulnerability and inadequacy, it may also betoken a kind of integrity and strength to resist that which is not of oneself. The cost to the bright conformers of moving successfully through the school years without having a chance to develop their own ideas or work for their own reasons is probably very high in terms of loss of creativity, originality and strength of inner-directedness. Many kids who don't do well in school are secret computer geniuses, because there nobody is telling them what to do.

The computer greeted him with exactly the words he himself had written in the story. He loved it.

There are teachers who are not afraid to renounce the safety, the predictability of a method in which they are the imparters of prescribed information to docile, uninvolved, anonymous minds. It has been my good fortune to work in a school where children are allowed freedom to learn. We hope that more people who are as truly themselves as they can be will go into teaching, or will start schools that will let other people — children — learn to be themselves also.

Computers can be a part of this. Our experience with computers at High Valley has been positive and enjoyable, and has shown the adaptability of computers to the alternative-school setting. ☐



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"I'm sorry. He just stepped out for a minute."

A School Computer, Yours For The Asking

Jim McCabe

Every year since my daughter, Kellie, was in the third grade at Sumac Elementary School in Agoura, I have taken my Altair computer into her classroom. We have played games like Hangman, Abagels, Number and Story. We have run simulations to sell apples, sell plants, and sell lemonade. We have studied our basic math facts, used our new vocabulary words, learned the state capitals, and asked the computer to guess which animal we were thinking of. We have had a great time!

Each year, I took the computer to school, one morning a week, for eight to ten weeks. The problem with a single small computer is that only a few children can use it at a time. However, in a ten-week period, everyone in a class of twenty-five to thirty students gets several chances, both as part of a small group and as "the computer operator" (typist).

I asked myself if I could acquire or build a computer to donate to the school at no cost to them; you have to start somewhere, and a dream is as good a place to start as any.

This year, Kellie entered the sixth grade at Lindero Canyon Middle School. Now here's the rub. Instead of having the same twenty-five to thirty students in her class all day, every fifty minutes a bell rings and a different group of twenty-five or thirty new students is ushered in. How many weeks of one-morning-a-week sessions would it take to satisfy that gang? It seems impossible. My boss is understanding, but we do have work to do.

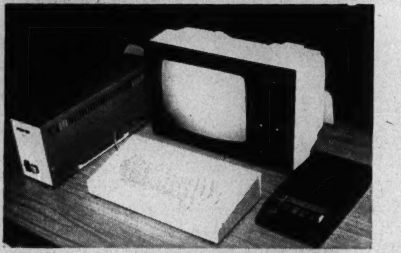

Photo 1. Lindero Canyon Computer #1.

One solution was to let the school borrow my computer on a full-time basis. I don't use the computer during school hours, but I do use it in the evenings and on weekends. Either I would have to transport the computer to and from school each day, or I would have to do without the computer in the evenings and on weekends. I didn't like either of those alternatives. Also, someone at school would have to be trained to use the computer and to handle any problems that arose. There were other problems with this arrangement. Something might be broken or just fail, and that might cause strained relations between the school and me. While this solution might be feasible for some, it was not feasible for me.

It seemed to me that if the children at Lindero Canyon were going to experience computers, they would have to have their own. That meant that they would have to buy one or someone would have to give them one.

Since we Californians passed our infamous Proposition 13, which lowered our property taxes, some school activities have been cut back. This very year, one elective course has been removed and the number of class periods reduced at Lindero Canyon. I am not personally convinced that all this austerity was necessitated by Proposition 13, but the cuts in school budgets are real. This meant that the possibility of the school buying a small computer was so remote that I didn't even bother to call to ask about it. I asked myself if I could acquire or build a computer to donate to the school at no cost to them and at little or no cost to me. It sounded like a dream, but you have to start somewhere, and a dream is as good a place to start as any.

I started by assessing my own computer system. In 1976, I had begun with an 8080 CPU, a cassette tape interface, a 16x64 character video interface, a keyboard, a video monitor, a tape recorder, and four 4K memory boards. That system had served me well for nearly two years. As a minimum, I wanted to duplicate that system. Also a PROM board would be needed. For the first couple of years, I had to key in a bootstrap loader from the front panel switches each time I turned the computer on. The PROM board would eliminate that hassle.

I will spare you the details, but I would suggest involving both hardware and software experts in such a project if possible.

So, the first goal was to produce a 16K, cassette based, 8080 computer. The second goal was to produce such a system, which had cost approximately $1600 in 1976, for no cost in 1980. It sounds like

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Vector Graphic 8080 CPU board
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Figure 1. Computer #1 equipment list.

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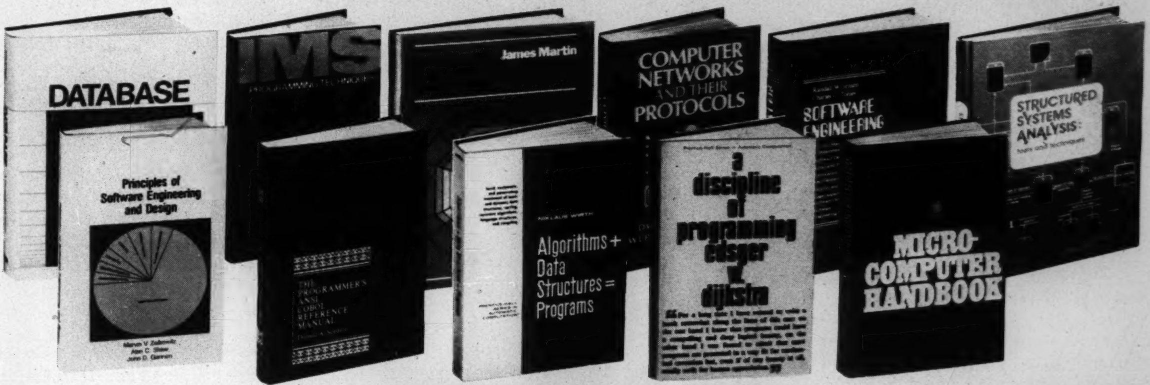
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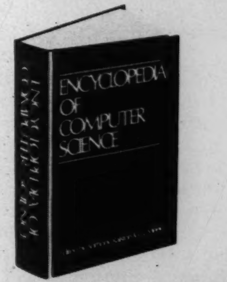

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Asking, cont'd...

magic, doesn't it?

On February 25, 1980, a 16K, cassette based, 8080 computer was delivered to Lindero Canyon Middle School. The total cost of the system to the school was $150, the cost of a 12" video monitor. The video monitor was the only part of the computer that I couldn't get someone to donate. On April 7th, a second computer was delivered. The second one was donated completely. It is a disk-based Z80 small computer with 48K of memory. We hope to add a high resolution graphics capability soon. See Figures 1 and 2 for the complete equipment lists of both systems.

How did I do it? What mystical force persuaded people to donate components and computers to our school? Let me explain the simple process.

The first thing I did was to contact the principal of Lindero Canyon, Mr. Joe Nardo. After all, if the school wasn't interested, I wasn't going to get very far. At best, my efforts would be wasted and the computer might not be used. Fortunately, Mr. Nardo and some of his teachers were already discussing the use of computers at Lindero Canyon. They were delighted that a knowledgeable parent was interested in helping them acquire a computer. Most of all, the price goal I had set fit their budget! Mr. Nardo told me the Las Virgenes Board of Education would acknowledge all donations by letter.

I asked if he would consider donating a cassette interface for a school computer. He said sure.

Armed with the principal's blessing and the knowledge that donations would be officially acknowledged, I was ready to start soliciting. Again, my own experience provided a starting point and a plan of attack. I had, in upgrading my computer system, replaced several boards which were now stuck in a box in the closet. I reasoned that other computer hobbyists had done the same thing. I would use my extra boards and call some of my hobbyist friends to solicit their help. I had an 8080 CPU, a cassette tape interface, and a 16x64 character video interface. If I donated these items to the school and received written verification, I felt the donations would be tax deductible. (I should point out that I am not a tax expert, and you should consult one to determine the truth of that assumption).

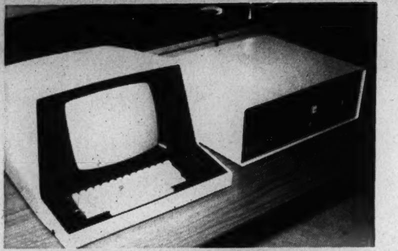

Photo 2. Lindero Canyon Computer #2.

My next concern was to find a main frame in which to put these and the other components. This would be hard to come by from my hobbyist friends. Not many of them ever upgrade the main frame. I checked with Gordon Hart, the electronics teacher at Agoura High School. I have been a volunteer software consultant to Gordon for the past two and a half years. Agoura High has several complete small computers, and I was aware that they also had pieces of others. When I told Gordon what I had in mind, he pulled out a POLY 88 main frame, a keyboard, and a cassette recorder. He said he would loan them to Lindero Canyon for as long as they needed them. Both schools are in the Las Virgenes School District, so this may account in part for the willingness to share.

As welcome as the components from Agoura High were, the most valuable thing I got from Gordon was some advice. I told him about the cassette interface that I was donating to the Lindero Canyon computer. It no longer worked correctly and I lacked the technical expertise to fit it. My idea was to contact the manufacturer of the interface and ask if they would repair it, free of charge, as a donation to the school. Gordon's advice was this. First ask if they will donate a *new* cassette interface to the school. If they won't donate a new board, then you can ask about a free repair job.

I called the manufacturer and asked to talk to the president. Following Gordon's advice, I asked if he would consider donating a cassette interface for a school computer. He said sure. That telephone call opened my eyes, and it should open your eyes too. The key thing that I have to say to you is that you'll never know if someone will donate components or computers to your school unless you ask.

I had set out to build the school a used computer from discarded parts. At this point, my goals changed. Now, I wanted a new small computer for the school at the same cost. Incidentally, I donated the old cassette interface board to Agoura High. Gordon and his students fixed it and it is now operating in one of their computers.

```
Vector Graphic MZ main frame, power supply, and mother board
2 Micropolis quad density disk drives
Vector Graphic disk controller
Vector Graphic "mindless" terminal
Vector Graphic 12K PROM/RAM board
Vector Graphic Flashwriter II video interface board
Vector Graphic Z80 CPU board
Vector Graphic 48K RAM board
```

Figure 2. Computer #2 equipment list.

Flushed with the sense of accomplishment I got from the first call, and armed with my new goal, I called a local computer manufacturer. Vector Graphic has their production facility in Westlake Village, less than five miles from Lindero Canyon. They manufacture a variety of small computer components as well as complete small computer systems. I have three of their boards in my own system, so I am familiar with their product line, and they had everything I needed to complete the system.

I asked to talk to Carole Ely, Vector Graphic's Marketing Vice President. Carole is a lady I met several years ago when I was active in the Southern California Computer Society, but she had no reason to remember me, and I don't think she did. The main point is that when you call a manufacturer to ask for a donation, make sure you talk to someone who can make a decision.

The first two times I called, Carole was busy in meetings. (That is a penalty you have to pay when you insist on talking to someone who can make a decision. They are usually busy, making decisions.) But a major ingredient in getting this job accomplished is persistence. You must perservere. You must also use good judgement, however, to stay on the favorable side of the persistence/annoyance border. Someone who is annoyed at your constant interruptions will probably be in no mood to help you.

Armed with the Principal's blessing and the knowledge that donations would be officially acknowledged, I was ready to start soliciting.

On the third call, Carole was free. I explained my project to her and told her that all I needed to complete the system were three boards, a PROM/RAM board, a 16K memory board, and a video interface board. I still planned to use my 8080 CPU board.

She asked me what the school was going to do with the computer. Since I had already discussed this with Mr. Nardo, I was able to tell her in general terms what they were planning to do. At the end of our conversation, Carole said she was sure they could find the boards to donate to us, and assigned one of her technical people, John Irwin, to follow up on the matter. Most of my contacts with Vector Graphics after this were with John and his people.

The donated boards were not to come from the stock room. All manufacturers occasionally have production runs from which some components emerge cosmetically defective. The boards we were to receive were to be of this category, electronically sound, but cosmetically

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Asking, cont'd...

defective. I had no objection to this since the components would be inside a cabinet anyway. The problem is that cosmetically defective parts are not made on demand, and if you have a good operation, they are rarely produced. Vector Graphic has a good operation.

The ideal trait in this phase of the project is patience. I found it very difficult to just sit by the phone and wait for a call from John. I called every two weeks to check on the status of "our" boards. That interval is probably acceptable, but as time passed, the interval between calls got shorter and shorter. While I was waiting for the rest of the hardware, I re-wrote the PROM monitor to support the particular hardware that the school would have. At last, John called and said he had all three boards.

The next phase was the most frustrating of all. Theoretically, I just had to plug the five boards into the mother board, hook up a few cables, turn it on, and away we go. Any of you who have tried to integrate components from three manufacturers know that it isn't always that easy. Though, in retrospect, I must admit that most of the fault in this particular system integration stemmed from my being a neophyte in the hardware area. I will spare you the details, but I would suggest involving both hardware and software experts in such a project if possible.

That is a penalty you have to pay when you insist on talking to someone who can make a decision. They are usually busy, making decisions.

For Lindero Canyon, my hardware ineptness was a blessing in disguise. Finally convinced that my Altair 8080 CPU board was the villain (a false conclusion in retrospect), I once again called Carole Ely at Vector Graphic and asked if she would bail me out by donating a Vector Graphic CPU board. She agreed.

We had a chance to talk some more about the use of small computers in school and Carole amazed me by offering to donate a second small computer. This one was to be a complete Vector Graphic system. She asked me to describe a system that the school could best use. I was unprepared for that question and my answer was not too complete.

I later got together with the principal, Mr. Nardo, and one of his teachers, Mark Petrusson. We made up a wish list in writing and gave it to John Irwin at Vector Graphic. The list was in order by need. We didn't know if Vector Graphic would give us everything on the list, but we described a very complete computer system with some extras that would be nice. Among other things, we asked for two Micropolis disk drives. This would make the school system compatible with my own which would allow me to generate programs at home for use on the school computer.

Photo 3. Teacher Mark Petrusson demonstrates cassette loading techniques to members of his 7th and 8th grade electronics class.

My search for a free computer for the children at Lindero Canyon was successful beyond even my dreams. The reason I wrote this article was to provide encouragement to other schools. Our situation was not unique, and I had no special talents of persuasion. I believe that you can also acquire a computer for your school.

The procedure is as I have outlined it. First, contact the school officials to determine if there is an interest in computers. You would think that all schools would be interested, but I have encountered some who were lukewarm, at best. You need not only interest, but enthusiasm (preferably the wild variety) from the school to get you over the hard spots. Some people are going to say no. Frustrations will arise. At those times, it's nice to have an enthusiastic and supportive Principal to lean on.

Discuss with the principal and interested teachers what use could be made of computers in the school. Dispel any stereotypical feeling that computers just belong in the math department. They do belong in math classes, but they also belong in science, English, language, and history classes. These are general-purpose computers and they should have general-purpose use. The other thing that I feel very strongly about is that the computers should be available to the widest possible cross section of the student population. Computers are not just for the mentally gifted!

Set some goals. Define a minimum computer system that is useful, and define a super system, just in case it might be attainable. Pay particular attention to those items that may be especially suited to educational environments. My own personal bias here is that graphics of any kind, and high-resolution graphics in particular, are excellent media through which to present educational material. Color graphics and voice I/O as well as analog control devices are also useful. Think BIG!

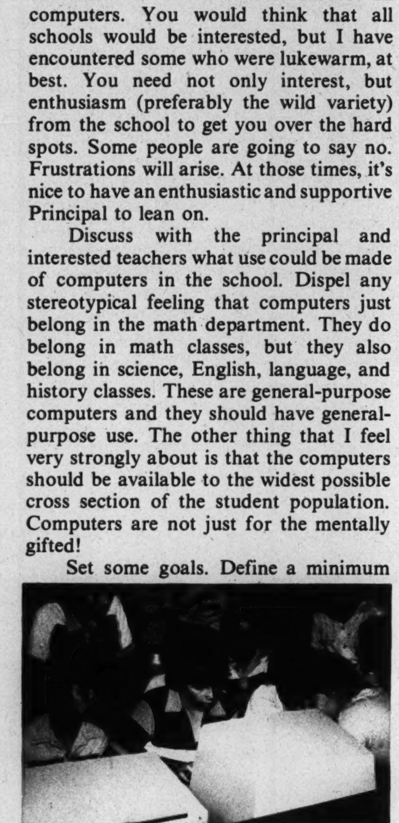
Photo 4. A regular meeting of the Lindero Canyon "Me next" Chorus.

With the groundwork done, you are ready to start the big scavenger hunt. I believe the path I followed is not the only path that will produce results. Here are some other ideas.

The path I first started on can be productive. Many computer hobbyists across the country have been upgrading their systems. Building a system with those now unused parts is feasible, all you have to do is find them.

This is how you find them.

Check with local computer stores. Ask for the names and addresses of local computer clubs. Find out about any local computer or electronic swap meets. Ask if you can leave a notice on their bulletin board. While you're there, ask if they would consider donating equipment to your school. Many computer stores are not large enough businesses to be able to afford hardware contributions, but perhaps they can provide other, less costly items. Ask about software (computer programs), books, magazines, or just helpful advice.

Dispel any stereotypical feeling that computers just belong in the math department; they also belong in science, English, language, and history classes.

Attend local computer club meetings. These meetings usually have a question and answer session during which you can get up and make an appeal for donations of unused boards. If you need help in hardware or software expertise, the computer clubs can fill this need. Ask!

Go to the swap meets. I have talked to someone who picked up a POLY 88 mainframe, just like the one Lindero Canyon has, for $25. If you don't know what to look for, try to arrange to take someone from the computer club with you.

Contact local manufacturers. Get their catalog or brochures to familiarize yourself with their product line. Make a list of those products your school could use and prioritize the list. Find out who in the company can decide to make a donation to your school. Call and talk to that person. If the opportunity presents itself, suggest that cosmetically defective parts are acceptable.

If you or someone else on the project have a solid hardware background and the proper tools, you might also suggest that you have the capability to repair electrically defective boards. Each of these suggestions can be a fallback position. That is, first ask for a new component. If that is not possible, suggest the cosmetically defective option, and as a last resort, ask about electrically defective parts.

You might also point out the possible tax benefits and advertising benefits. Children who use computers in school do develop an above-average likelihood of buying their own computers. They might also tend to buy a system like that with which they are familiar.

Accept any negative decision gracefully. Rejection is hard to take, but remember, it's not personal.

Next, try other local schools. I doubt that you will find any school willing to part with a complete computer, but they might share surplus components. Another technique might be to arrange a trade of surplus computer components from one school for surplus equipment of another kind from the second school. Many high schools and colleges now have small computers. Even if they can't provide hardware components, perhaps they will tell you how they acquired their computers. Maybe they will offer to share some software with you when you do get your own computer. They might set up field trips if you have a group of youngsters who just can't wait. Colleges might arrange to teach some in-service courses to teachers from your school to introduce them to the uses of the small computer in education. Get whatever help you can.

Photo 5. A band of Lindero Canyon "Adventurers" enjoy their latest discovery.

The emphasis on "local" computer stores, computer clubs, manufacturers, and schools should be obvious. People are more interested in a school which is in the neighborhood. They are more apt to donate to a school that they know. Perhaps, if you are lucky, they will have children who either are attending or will attend your school. So check all the sources in your local area first. Then, if you can't fulfill your needs from them, try areas farther away.

Good luck in your quest. I am not able to predict the success that each of you might have, but I am convinced that there are small computers out there that can be yours for the asking. I know that some of you will succeed. But if you don't ask, you'll never know! Make the assumption that the existence of donors is as real as your needs are. I *can* predict the outcome if you don't try to find these donors.

As for Lindero Canyon, we now have our first two computers and our new goal is to have at least four computers by the end of the year. There are approximately 1200 students at Lindero Canyon. That is one computer for each 300 students. (Perhaps our goal is too low.) Another parent at Lindero Canyon has just donated a Micropolis disk drive and controller. This gives us a start on the third computer, but we will need more help in meeting our new goals. Anyone who would like to provide some of that help should write to us at:

Mr. Joe Nardo, Principal
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Our program of computer usage at Lindero Canyon is small now, but it is growing, and it is going to be a good one. □

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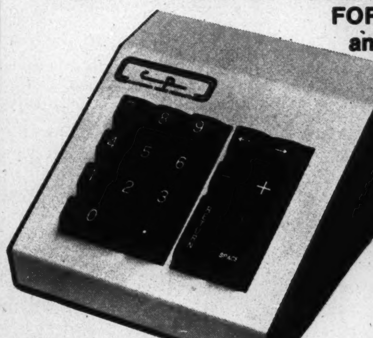

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SOFTWARE PROFILE

A Buyer's Guide to Apple II Software

David Lubar

Software is the food on which computers thrive. This article will suggest some guidelines for selecting software, with an eye toward avoiding junk food.

In games, a major consideration is the length of time that the program will interest you. Some games, though challenging at first, can be quickly mastered. If you can get a perfect score by using a simple technique, play will turn from fun to drudgery and the program will end up as nothing more than an expensive dust-catcher.

Games which can be conquered should not be confused with those that favor certain strategies. *Super Invasion,* for example, does favor certain techniques, but the game is so difficult, well constructed, and addictive that knowing the best strategy won't reduce the pleasure of play.

When trying a game, ask yourself whether you will play it more than a few times. Is there some trick which, once mastered, will turn the game from a challenge into a bore? Are there several skill levels and other options? Does the initial set-up vary?

On the other hand, certain games are played by figuring out how to master them. *Adventure* would be an example of this. You get hours of entertainment trying to figure out what to do. But, once you've solved all the problems, the game is over. You might want to try one (Adventure International is thoughtful enough to offer a sampler for a modest price), and then determine whether the length of play justifies the price. Many persons (I'm one) believe these games are worth the price. There are also adventures of the dungeon type that have random events which allow for variety and more playing time.

Some Good One-Player Games

Apple Bowl (from Apple). This is a well-constructed game. You get a perspective view, in high resolution, from the bowler's end of the lane. Paddles control the speed and angle of the ball. One button will give a left hook, the other a right hook. When released, the ball moves exactly as a real ball would. For instance, to make the 6,7,10 split, a right handed bowler would throw a fast hook, angling toward the gutter so the ball could slide into the 6,10 pocket. In *Apple Bowl,* this technique produces the expected results. You can almost see the ball fighting the angle of release as the hook takes over.

The game is for one player, but you can change the name on the score sheet at the end of ten frames. Since a moving triangle marks the spot where the ball is released, the game is not easy to master. And, once you can consistently throw a strike, you can always try a different speed and angle to renew the challenge. One last note: if you start the game when the paddles aren't plugged in, the program stops and asks you to insert the paddles. This is a nice touch.

Games which can be conquered should not be confused with those that favor certain strategies.

Rocket Pilot (from *Creative Computing's* Space Games-1). A variety of landscapes gives this lunar-lander simulation lasting power. Here, too, the laws of physics apply. An accelerating rocket cannot be stopped dead, but must decelerate. With a paddle each for horizontal and vertical thrust, you must fly over a mountain to a safe landing on the other side. Fuel is finite and crashes common.

Super Star Wars (from Programma International). This is a perfect example of a game which allows options. There are three versions (the third requires a joystick) and ten skill levels for each version. Using moving cross hairs, you have to destroy enemy ships. These ships swoop in from the background, growing larger as they approach. If they get past your defenses, they'll shoot you, reducing your energy. The easy levels allow you to learn the game. The hard levels provide a true challenge.

For two-player games, the big question is: How much are you willing to spend for the bookkeeping functions provided by the program? To take an extreme example, a game which merely keeps track of the moves made by two players in tic-tac-toe had better be priced well under a dollar. The programs that are really useful are those which handle complicated rules or tedious computations. Othello, for instance, is much more enjoyable when a computer flips the pieces.

Some Good Two-Player Games

Super Pro Football (from Aladdin). Generally, a football game on a computer brings to mind scrambling players tossing a graphics ball. A game without players on the screen might seem mundane. Not so with Aladdin's *Super Pro Football.* The two players choose from a list of ten plays for offense and six for defense. The results, derived from an NFL probability curve, are displayed in text and by moving the ball on a low-resolution field. The Super Pro part comes from choosing one of the Super Bowls to replay. The lineup is entered using information provided in the booklet which comes with the cassette. The names are used for color commentary ("Bradshaw pass to Swann complete") but do not affect the results.

The game is well designed, but there is one flaw. Each player has 15 seconds to pick a play. This is the only time when the clock is running. In real football, the offense controls the clock. In Aladdin's game, the defense can also control the clock, letting time run out if it is ahead near the end of the game. Even with this flaw, the game is very good. Strategy is deeply involved and, as the clock runs down, the excitement can become very intense.

Blockade (from Muse's Side Show). This is modeled after the arcade game where two players try to build walls without crashing. Control is from the keyboard. Unfortunately, the return key is one of the controls. If this is pressed when the game ends, it will cause an error since the program expects a numerical input for the start of the next game. Still, with five other games on the cassette, this isn't a bad buy.

Utility Programs

Another important type of software is utility programs. Somehow, this is an area where prices can really get out of control. Programs which are available in magazine listings, or in inexpensive packs, are being sold by some vendors for outrageous sums. The obvious question is: How useful is the utility? If you do a lot of machine-language programming, a text editor is almost a necessity. If you never enter the monitor, a text editor would be a waste of money. Ease of use is another factor to consider. If you have to enter ten or twenty POKEs to get a utility to work, it might not be that utile. Does it follow standard Apple conventions? If not, it could make more work than it saves.

Woz Pack (from A.P.P.L.E.) is a good utility program. This contains eight utilities, including a HIRES aid for Integer Basic which functions in the same manner as the ROM routines. Also included: Lazarus, for reviving dead programs; Pack & Load, for putting machine language into Basic programs; and utilities which list variables and referenced lines.

For two-player games, the big question is: How much are you willing to spend for the bookeeping functions provided by the program?

These programs are all nice, but the inclusion of a text editor, *TED II*, makes *Woz Pack* an incredible bargain for anyone who uses machine language. *TED II* is easy to use, and it accepts Sweet-16 op codes. What more could you want? Documentation? Here, too, *Woz Pack* is superb. Besides complete listings, the book contains a number of valuable hints, tricks, and techniques.

Whenever possible, try software at a dealer before you buy it. If the store won't let you do this, find another store. Try making errors to see whether the game or utility traps them. If you order by mail from a new company, try a small order first. The most important thing is to balance the cost of a program against the factors mentioned in this article, and against other factors which might be specific to your needs. A game that will be interesting for only a limited time might be worth a few dollars. A game that you won't tire of could be worth more than that. Utilities that save time and effort can be invaluable. But check the back issues of your magazines; that utility you need might be listed in one of them.

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‡General Ledger	$449/$35
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#Payroll	$747/$25
#Inventory Control	$447/$25
#Analyst	$197/$15
#Letteright	$167/$25
#NAD	$ 87/$20
QSORT	$ 87/$20
GRAHAM-DORIAN ¶	
#General Ledger	$793/$35
#Accts Receivable	$793/$35
#Accts Payable	$793/$35
#Payroll	$493/$35
#Inventory	$493/$35
#Cash Register	$493/$35
#Apartment Mgt.	$493/$35
#Job Costing	$793/$35
MICRO-AP	
#Selector III-C2	$269/$20
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S-Basic Compiler	$229/$25
WHITESMITHS	
*"C" Compiler	$600/$30
*Pascal (incl "C")	$750/$45
S.O.F.T.W.A.R.E. ¶	
‡Microtax®—Prof. tax preparation	
Federal individual	$749/$50
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‡Business Plus®	
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Accounts Receivable	$ 79/$25
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Payroll	$ 79/$25
All 4	$269/$99
SUPERSOFT	
¶Forth	$129/$25
Diagnostic I	$ 49/$20
Other disk software	less 10%

APPLE II®	
MICROSOFT	
Softcard (CP/M)	$292
PERSONAL SOFTWARE	
Visicalc®	$122
CCA Data Mgr.	$ 84
Desktop/Plan	$ 84
MUSE	
Super-Text	$ 84
Other disk software	less 10%

TRS-80® MODEL II	
CP/M 2.2	$149
Electric Pencil II	less 15%

TRS-80® MODEL I	
CP/M 1.4	$129
CCA Data Mgr.	$ 68

Other software requirements—Call

CP/M users: specify disk systems and formats. Most formats available.
★—Special Bonus with order ‡—Requires microsoft BASIC ¶—Supplied in source code
#—Requires CBASIC-2 ®—Mfgs. Trademark

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CIRCLE 182 ON READER SERVICE CARD

Milliken Math Sequences

Isaac I. Bejar

Real in-earnest CAI sequences are hitting the market. Here's one that starts from the proposition that big producers will make the best software.

Some say that one of the greatest obstacles to the acceptance of Computer-Assisted Instruction (CAI) is the lack of a market incentive to produce instructional materials. If so, then the recent appearance of several educational software packages by *established* educational publishers may mean that CAI has come of age. The entrance of these publishers into the educational software market is important, because pedagogically sound material is most likely to originate from established, educationally-oriented firms who have the necessary expertise. For this very reason, however, the quality of these pioneering packages is all the more important. If they are not well received they may delay a wider implementation of CAI. On the other hand, if they *are* well received, then CAI may at least establish a firm (and ever-increasing) foothold in the educational scene.

Publishers seem to have concentrated on mathematics instruction, and it is not hard to understand why. Not only is the mathematics curriculum well delineated and fairly constant across schools, but (in addition) mathematics drills are easy to program! At least three packages have been introduced recently for elementary mathematics instruction. One package is put out by The Dallas Independent School District, another by Radio Shack. A third package, and the object of this review, was introduced recently by Milliken Publishing Company, St. Louis, Missouri, and is called the Math Sequences.

Description of the Package

The Math Sequences provide drill practice in the basic mathematical skills that are taught in grades 1-6. The package was developed in conjunction with WICAT of Utah, a company which specializes in technology-based instruction. It is available for the PET, Apple and TRS-80 computers. The cassette-based package sells for $200. There is also a disk-based version for the Apple, which sells for $300. This review is based on the TRS-80 version.

When the student has been judged by the program to master a subskill, he or she is presented with two options: either go on to the next level or stop.

The package consists of 12 cassettes and includes a teacher guide. The guide outlines the broad skills contained in the package, and gives information on how to use the TRS-80. The instructions are also described in a step-by-step fashion in a separate card which the teacher can keep next to the TRS-80. The instructions are accurate and should be understandable by anyone. The Teacher Guide also contains the forms which the teacher may find useful: A Student/User Schedule, Student Progress Chart, a Class Evaluation Progress Chart, and an Assignment Sheet. The rest of the Teacher Guide contains examples of the problem-types included in each tape.

The Math Sequences have been programmed in Basic. I have not experienced any difficulty loading any of the tapes at the recommended volume setting of 6. The presentation of each problem is very clear. Upon responding, the student is given feedback. If the correct answer is given, positive feedback (e.g., WOW, flashing YES) is displayed. Otherwise the student is told to try again. If the student does not answer correctly on the second try he is told what the correct answer is and moves to the next problem.

The sequences are divided into nine broad skills, or "strands." Each skill is divided into subskills, or "levels." The subskills within a strand presumably form a hierarchy. That is, successful performance of a subskill requires mastery of all other subskills that are further below in the hierarchy.

The subskills for each strand appear to be very comprehensive, at least from a logical standpoint. For example, addition to 9 is divided into three subskills:

Sums from 1 through 5
Sums from 0 through 5
Sums from 0 through 9

Then, within each subskill the questions are presented in three formats:

$2 + 3 = x$

$4 + x = 5$

$$\begin{array}{r} 2 \\ \underline{+3} \end{array}$$

Evaluation

One obvious challenge facing the designer of educational software is providing sufficient flexibility so that the software package can be tailored to the needs of various curricula.

Milliken has made an effort to make the package flexible by including only one problem type in each level (except in the review lessons). This would allow the teacher great flexibility — provided the

Isaac I. Bejar, Educational Testing Service, Princeton, NJ 08541.

teacher had control over the branching sequence. If the sequencing of the skills assumed by Milliken is not compatible with that being used by the teacher, he or she, in principle, can skip a subskill and return to it at a later time.

This unfortunately is not easy to do, for the math sequences allow only one sequence. For one thing, there is no cross-indexing of each subskill with the major textbooks. Therefore it would be difficult for the teacher to plan the appropriate sequence. Even if the teacher can plan the sequence, it would be awkward to stick to it. When the student has been judged by the program to master a subskill, he or she is presented with two options: either go on to the next level or stop. In the latter case a summary of the student's performance is given along with a statement as to which subskill should be attempted next; there is no option to go on to some other, non-consecutive subskill except by signing on again. In short, it would be awkward for the teacher or parent to tailor the package to a sequencing of skills other than the one assumed by the developer.

The student is moved to the next higher level if performance is better than 70%. These criteria might at first appear reasonable, but in reality are not totally adequate.

Content Coverage of the Math Sequences

Strand	Grade Level	No. of Levels
Addition	1-5	100
Subtraction	1-5	57
Multiplication	3-5	61
Division	3-6	65
Laws of Arithmetic	3-5	23
Negative Numbers	6	38
Fractions	4-6	49
Decimals	5-6	71
Percents	6	16

Table 1

Another important criterion of an instructional software package is adequacy of subject matter coverage. The skills and grades covered by the Math Sequences appear in Table 1.

Conspicuously absent is the topic of *measurement,* which is not taught here. This is unfortunate for two reasons. First, by ignoring measurement, the producers passed the opportunity to use the graphics capability of small computers. Second, and perhaps more importantly, teachers find measurement a difficult topic to teach. By ignoring it the producers missed a chance both to impress teachers and truly to improve current practice.

Another important component of an instructional package is the adequacy of the statistical criteria — the thresholds of correct student response — which underlie the branching decisions. In the Math Sequences they are as follows: If the student misses three problems in a row, or the proportion correct falls below 30% after the minimum number of problems for that level have been presented, the student's level is reduced by one. The student is moved to the next higher level if performance is better than 70%. These criteria might at first appear reasonable, but in reality are not totally adequate. To illustrate, consider one actual sequence of problems I obtained by answering incorrectly on the first try of the problem and then correctly on the second try:

a) $1 + 1 = x$
b) $2 + 1 = x$
c) $2 + 1 = x$
d) $1 + 3 = x$
e) $1 + 2 = x$

Several problems are evident. Note first that two of the five problems are identical, b and c. Therefore in reality I have been given only four problems. Second, but more disturbing, is the fact that a student who misses on the first try (like the one I simulated) would be judged equally as proficient as a student who responds correctly on the first try. This is not only unreasonable, but the parent or teacher is not even alerted to the problem. Beyond that, no evidence is given supporting the validity of the cut-off scores — why not 80% or 90% success before moving into the next level?

Summary

I have identified several broad criteria that may be useful in the evaluation of instructional software packages:

- Human engineering aspects: e.g., attractiveness of display, ease of operation, etc.
- Adequacy of task analysis: are all the subskills identified?
- Completeness of subject-matter coverage.
- Adequacy of basis for instructional decisions.

The Math Sequences score well on the first two categories, but showed weakness in the latter two. The omission of the topic of measurement is unfortunate, as stated above. I suspect that graphics would have added substantial development costs and for that reason were omitted. If so, Milliken may have fallen under the influence of the vicious circle described by Anastasio (1972): given the uncertainty of the market, the software producer does not put out the best product. But precisely because the software leaves something to be desired, market reaction, too, may leave something to be desired. □

References

Anastasio, E.J. The study of factors inhibiting the use of computers in instruction. *EDUCOM-Bulletin of the Interuniversity Communications Council,* Spring 1972, 7(1).

COURSE
•WARE
(kōrs'wâr'),n.
Computer program designed to teach, reinforce and/or enrich.

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THE USER?
Fifth graders through high school.

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CIRCLE 155 ON READER SERVICE CARD

creative computing
SOFTWARE PROFILE

Chem Lab Simulations from High Technology

Chuck Carpenter

Two Apple II chemistry lab simulations for introductory chemistry are available from High Technology. Both were developed by Dr. J. I. Gelder from Oklahoma State University. The first deals with acid-base titrations, the second with gas laws and entropy. Each package consists of a 3-ring manual (19 pages for #1, 32 pages for #2) and a diskette. There is plenty of additional information in the programs. As you run the simulations you are given instructions, formulas and helpful prompts. With all the program documentation and the manuals as supplementary data, I was able to easily perform all the simulation experiments (and I haven't done anything with chemistry in years).

An ideal gas law simulation demonstrates the kinetic-molecular theory of a gas.

Documentation

Both packages include the same introduction. First is a brief description of the programs. Next, sections on how to use the manual and hardware requirements. The final two entries are how to run the simulation, and the protection of the diskette. Since the diskette cannot be copied, this one has special significance.

Following the introduction, each simulation is described. Theory is discussed and plenty of diagrams and formulas are used. There is also a section on experiment notes. These notes include the how-tos and supplement the instructions and prompting in the program.

Chem Lab Simulation #1

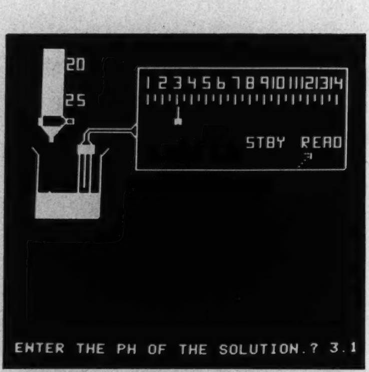
Three experiments are included in simulation #1. First, an acid-base titration simulating an example of the common laboratory procedure used to determine the concentration of an unknown acid. Second, acid-base titrations are performed to obtain the gram-molecular weight of a fatty acid. Then Avogadro's number is obtained by simulating a monomolecular layer of the fatty acid spread across a water surface. Third, an acid-base titration is performed giving the molar concentration of an unknown weak acid. Then, three partial neutralizations are performed in a PH meter simulation for identification of the weak acid.

High resolution graphics are used throughout the simulations. A buret, a beaker, the glass plate for the monomolecular simulation and the PH meter are included in various graphics displays. Think of all the lab equipment you *don't* have to buy. Color is included for the experiments but black and white works quite well. (I use a B & W monitor). I felt the beaker was out of proportion to the rest of the equipment (too small). Otherwise, the simulations were quite effective.

Chem Lab Simulation #2

There are two experiments in simulation #2. First is an ideal gas law simulation demonstrating the kinetic-molecular theory of a gas. A graphical demonstration of the behavior of a gas is possible by varying the pressure, volume, temperature and the number of moles of the gas. The second experiment is an entropy simulation. The display is a chamber divided into two compartments. In one part of the simulation two gases are allowed to mix, while in the second part, a gas is allowed to expand from one compartment to the other.

Low resolution graphics are used for these simulations. Sound is used to simulate the impact of molecules, and the game paddles and switches are used for some controls during the experiment. Other controls are defined by the keyboard. I was able to make all the controls work but didn't get a successful experiment. In a classroom environment there would be no problem since an instructor would be able to provide guidance. The display was in color but was no problem on my B & W monitor. Again, the simulations were very effective.



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ENTER THE PH OF THE SOLUTION.? 3.1
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What I Didn't Like

I considered the cost to be too high. You will have to buy one package for each computer you will be using. Although the contents require a knowledgeable person for development, there appears to be less work involved than several other software packages I have for the same money. Since the disk can't be copied, if you damage it you have to send to High Technology for another.

Conclusion

I have reviewed and used other teaching aids and found them to be hopelessly inadequate. These two packages are well done and provide a useful learning experience. Others attempting to write computer-assisted instruction programs would do well to use these as a model. Previous reviews I have written were critical of High Technology's sparse documentation. No problem this time. You can obtain Chem Lab Simulations #1 and #2 for $100.00 each from High Technology, Inc., P.O. Box 14665, Oklahoma City, OK 73113, (405) 840-9900. ☐

Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

Economic and Ecology Simulations

The Ecology Simulations series are a unique educational tool. They are based on "simulation models" developed by the Huntington Two Computer Project at the State University of New York at Stony Brook under the direction of Dr. Ludwig Braun. The programs and accompanying documentation are written for self-teaching or classroom use and include background material, sample exercises and study guides. Graphic displays were specially developed by Jo Ann Comito at SUNY and Ann Corrigan at Creative Computing. The Ecology Simulations packages are a remarkable educational application of micro-computers.

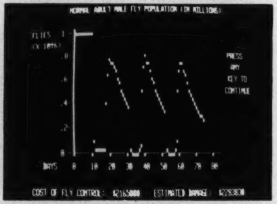
Ecology Simulations-1, CS-3201 (16K)

1. Pop

The POP series of models examines three different methods of population projection, including exponential, S-shaped or logistical, and logistical with low density effects. At the same time the programs introduce the concept of successive refinement of a model, since each POP model adds more details than the previous one.

2. Sterl

STERL allows you to investigate the effectiveness of two different methods of pest control—the use of pesticides and the release of sterile males into the fly population. The concept of a more environmentally sound approach versus traditional chemical methods is introduced. In addition, STERL demonstrates the effectiveness of an integrated approach over either alternative by itself.


NORMAL ADULT MALE FLY POPULATION (IN MILLIONS)
FLIES
(X 10↑6)
1
.8
.6
.4
.2
0
DAYS 0 10 20 30 40 50 60 70 80
PRESS
ANY
KEY TO
CONTINUE
COST OF FLY CONTROL: $2165000 ESTIMATED DAMAGE: $2283830

3. Tag

TAG simulates the tagging and recovery method that is used by scientists to estimate animal populations. You attempt to estimate the bass population in a warm-water, bass-bluegill farm pond. Tagged fish are released in the pond and samples are recovered at timed intervals. By presenting a detailed simulation of real sampling by "tagging and recovery," TAG helps you to understand this process.

4. Buffalo

BUFFALO simulates the yearly cycle of buffalo population growth and decline, and allows you to investigate the effects of different herd management policies. Simulations such as BUFFALO allow you to explore "What if" questions and experiment with approaches that might be disastrous in real life.

Ordering Information

The series is designed for the 16K TRS-80 Level II and is attractively packaged in a vinyl binder with a complete study guide. *Ecology Simulations-I:* disk CS-3501, cassette 3201. *Ecology Simulations-II:* disk CS-3502, cassette CS-3204. *Social and Economic Simulations:* disk CS-3508, cassette CS-3204. At a modest $24.95 each, the series is an affordable necessity.

To order, send payment plus $1.00 shipping and handling to Creative Computing Software, Dept. ACGG, P.O. Box 789-M, Morristown, NJ 07960. For Faster Service, call in your order toll-free to our order hotline 800-631-8112. In NJ call 201-540-0445.

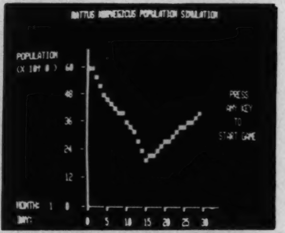
Ecology Simulations-2, CS-3202 (16K)

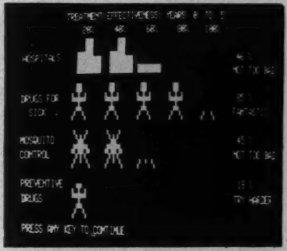
1. Pollute

POLLUTE focuses on one part of the water pollution problem; the accumulation of certain waste materials in waterways and their effect on dissolved oxygen levels in the water. You can use the computer to investigate the effects of different variables such as the body of water, temperature, and the rate of dumping waste material. Various types of primary and secondary waste treatment, as well as the impact of scientific and economic decisions can be examined.

2. Rats

In RATS, you play the role of a Health Department official devising an effective, practical plant to control rats. The plan may combine the use of sanitation and slow kill and quick kill poisons to eliminate a rat population. It is also possible to change the initial population size, growth rate, and whether the simulation will take place in an apartment building or an entire city.





3. Malaria

With MALARIA, you are a Health Official trying to control a malaria epidemic while taking into account financial considerations in setting up a program. The budgeted use of field hospitals, drugs for the ill, three types of pesticides, and preventative medication, must be properly combined for an effective control program.

4. Diet

DIET is designed to explore the effect of four basic substances, protein, lipids, calories and carbohydrates, on your diet. You enter a list of the types and amounts of food eaten in a typical day, as well as your age, weight, sex, health and a physical activity factor. DIET is particularly valuable in indicating how a diet can be changed to raise or lower body weights and provide proper nutrition.

Social and Economic Simulations CS-3204 (16K)

1. Limits

LIMITS is a micro-computer version of the well known "Limits to Growth" project done at MIT. It contains a model of the world that is built of five subsystems (population, pollution, food supply, industrial output, and resource usage) linked together by six variables: birth rate, death rate, pollution generation, resource usage rate, industrial output growth rate, and food production rate.

2. Market

Market allows two or more people to play the roles of companies who are competing for the market for a particular product: in this case, bicycles.

Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his/her company.

3. USPop

USPOP allows the user to study many aspects of the United States' human demography (population change) including population growth, age and sex distribution. USPOP makes population projections and investigates the consequences of many different demographic changes.

creative computing
EQUIPMENT PROFILE

Exatron's "Stringy Floppy" for the TRS-80

Fred Blechman

Even though I saw it advertised several times and read about it in two articles, I had no interest in the Stringy Floppy until I got my hands on one. Now I'm a believer! I'm not sure if the ads were too general, or the articles too technical, or that there's nothing like having the real thing and using it to really know what it can do.

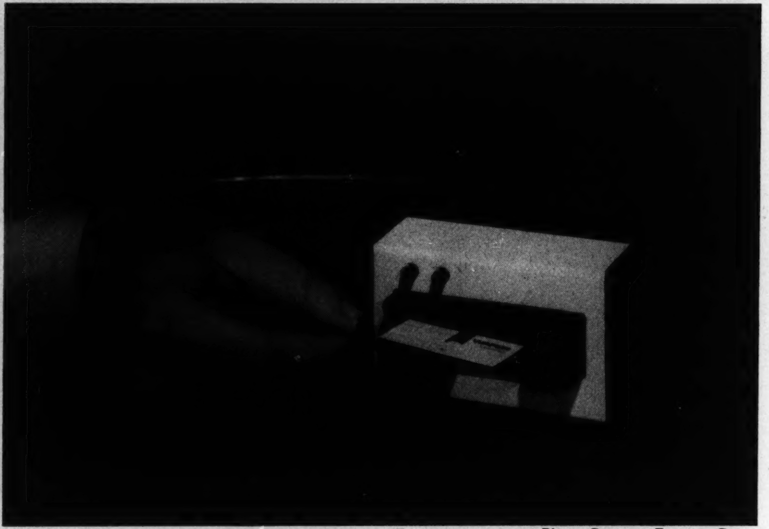


Photo Courtesy Exatron Corp.

Cassette Systems

Let's talk for a moment about the difference between cassette systems and disk systems. Cassettes are relatively slow. The TRS-80 Level II operates at about 500 baud — that's approximately 62 characters per second when loading a program onto a cassette from the computer, or loading a program from the cassette into computer memory. Cassette tapes are tricky to load, with head alignment problems, speed variations, tape variations, dropout, tape wrinkles, oxide flaking and such. You really have to CSAVE and verify at least twice for reliability. External DATA handling is too slow for most practical purposes. Changing programs requires making new copies, rewinding and then verifying with CLOAD? — just too time-consuming. However, cassette recorders are inexpensive. The tape cassettes are cheap (about 75¢) and are really great for "archival storage" — information you're going to keep for a long time and you're not going to use every day.

Exatron's Stringy Floppy is a "poor man's disk."

Disk Systems

Now look at a disk system. They're fast and wonderful — great for DATA handling, and extremely fast for loading and saving. But they're expensive! An Expansion Interface, with an additional 16K memory (which you almost have to get, since the disk operating system uses 12K all by itself — and with a 16K machine, that would only leave you with 4K) costs $448 from Radio Shack. The disk drive is another $449 — for a total of $937 (perhaps less if you have another source or use non-Radio Shack devices). The blank disks are about $5 each. And the disk system is also complicated, creating new problems for those who are not willing to spend the time and effort to learn it.

The Stringy Floppy

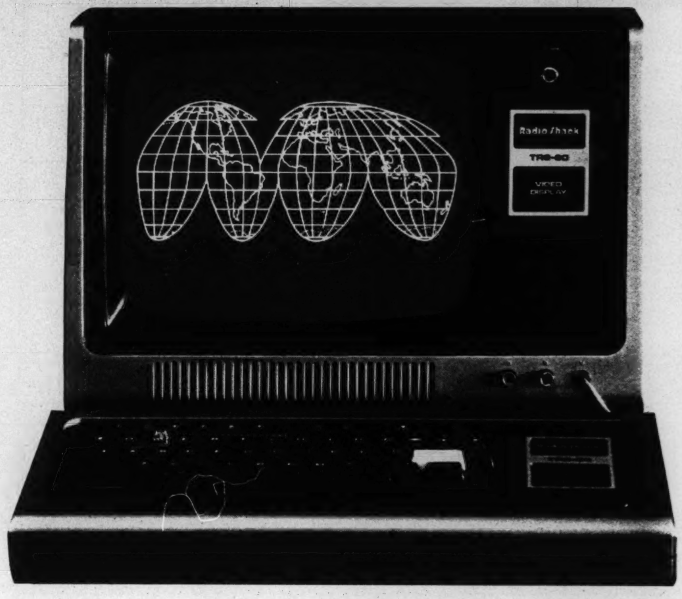
Now there's another alternative, Exatron's Stringy Floppy for $250 — a "poor man's disk."

Let me tell you some of the advantages. It's fast. (I mean fast for me. Maybe not fast for you people from disk-land.) It runs at 7200 baud, which is 14 times faster than the Level II cassette. Actually, it's 14.4 times faster. That's about 900 characters per second as compared to around 62 characters for Level II cassettes.

You don't need an Expansion Interface. The Stringy Floppy plugs right into the wall socket for AC power (no power stolen from TRS-80). It plugs right into the keyboard expansion slot, and has an extra connector to share the expansion port if you've got something already plugged into it.

You can put up to seven Stringy Floppies in daisy-chain fashion on one system, address them individually, and have them talk to each other — as compared to the normal maximum of four disk drives.

Fred Blechman, K6UGT, 7217 Bernadine Ave., Canoga Park, CA 91307.



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CIRCLE 121 ON READER SERVICE CARD

Floppy, cont'd...

Automatic Keyboard Debounce

None of Exatron's literature or advertisements even mention what I'm about to tell you. When I discovered this I called up Bob Howell, Sr., the President of Exatron, long-distance to confirm it. He said, "Oh, yes, the Stringy Floppy automatically debounces the keyboard. I guess we should mention that . . . "

The Stringy Floppy requires *no RAM memory* from the TRS-80! It has its own EPROM — erasable programmable read-only memory. While it utilizes space in some operating system areas, it does not interfere with normally accessible memory.

> **"Oh, yes, the Stringy Floppy automatically debounces the keyboard. I guess we should mention that..."**

It's self-verifying on loading and saving. When you tell the Stringy to save a program, it puts the program on tape, then goes back and checks every single byte. So you don't have to make two copies of everything, then rewind and CLOAD? verify.

Wafers

The Stringy Floppy uses little "wafers," $2 each, and smaller than a business card. In fact, I store my wafers in the jackets of plastic business card holders. Each can hold over 48 thousand bytes. Not bad for something this small. It's only 3/16 of an inch thick, and looking down from the top it's 2¾ inches by 1½ inches.

Inside, the wafer is a *continuous loop* of 1/16 inch wide tape — so narrow it looks like a string, hence the name "Stringy Floppy."

The wafers come in four different lengths: 5 feet, 10 feet, 20 feet and 50 feet. Just remember the numbers 4-5-6 and it's easy. A 4K wafer — that is, it will hold 4000 bytes — is 5 feet long and runs around its whole length in 6 seconds; 4K, 5 feet, 6 seconds. Now if you extrapolate that, 8K uses a 10 foot wafer and runs 12 seconds; 16K uses a 20 foot wafer that runs 24 seconds; and 40K fits on a 50 foot wafer that runs 60 seconds. Actually, I've found the 50 foot wafers really hold over 48K, so either the tapes are longer than marked, or the byte density is somewhat higher than 4K on 5 feet. (The $2 price is the same for all lengths.) Somewhere on it there's a little metal foil about ½ inch long, to indicate the end-of-tape/beginning-of-tape location to a pickup in the tape drive.

On top of each new wafer is a small ½ inch diameter silver paper reflective disk. If this is removed, or covered over with black paper, the Stringy Floppy will not record.

@NEW(n)	— Verifies Ability of Tape to Hold Bits Along Entire Unused Portion. (n) Optional.
@SAVE(n)	— Writes Numbered Program and Verifies Each Byte. (n) Required.
@LOAD(n)	— Loads Next (If No (n)) or Specified Program Into Memory With Parity & Checksum Verified.
(Note: @ May Be Shifted or Unshifted)	

Table I. Stringy Floppy Commands

PROGRAM	BYTES	SECONDS TO LOAD	
		LEVEL II CASSETTE (500 BAUD)	STRINGY FLOPPY (7200BAUD)
TRS232 Printer Driver	1734	32	2½
Telephone Toll-Charge	2853	48	3½
Simplified Bookkeeping	3163	54	3½
Telephone Dialer/Timer	5139	86	6
Distributor Records - Amway	7687	127	10
Order Verification - Amway	10417	171	14

Table II. Loading Time Comparisons

In other words, if you want to protect a program on the wafer from being recorded over, remove or cover the silver disk. This wafer would then be called "write-protected." This is like removing the break-away tabs at the back of a cassette.

Other Things

The Stringy Floppy is fast enough to make DATA handling practical. An internal buffer spits out 256 bytes of DATA about every second, just like that, into your computer memory — or from the computer to a DATA tape.

You can also load and save machine language programs, and a monitor program is available for machine language geniuses. (As for me, I've got my hands full with just Basic.) Incidentally, the Stringy Floppy does not interfere in any way with your regular cassette operation — you can CSAVE and CLOAD just exactly as you did before.

Installation

The actual unit is four inches wide, six inches deep and only two and a half inches high, and weighs about two pounds. The black and gray metal and plastic cabinet is a perfect match for the TRS-80. That's all there is to the installation. The wafer just pushes into the slot on the front of the unit. There are no controls on it; just two light-emitting diodes, one to show that the drive motor is operating, the other to tell you when it's writing on tape.

Using The Stringy

Use of the unit is simplicity itself. When it's connected and the computer is turned on, the display will show MEMORY SIZE? If you need to reserve memory for some other use — printer driver or whatever — type in the number you need in the normal fashion. When you press ENTER you'll be in Basic with a READY on the screen. Type in SYSTEM and press ENTER, then type in /12345 and press ENTER. The screen will now come up with:

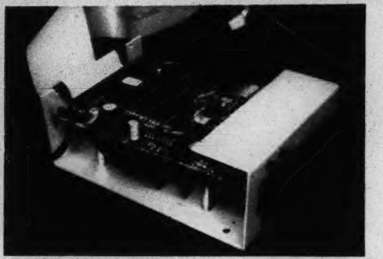
```
EXATRON STRINGY FLOPPY
    VERSION 3.2
```

and READY. You're in Basic and your keyboard is debounced! Check your memory with ?MEM and you'll get the same number you would without the Stringy Floppy on line (15572 for 16K unit with no memory reserved).

New Commands

You have three new commands when you've done this (see Table I). @NEW (and you can use an upper or lower case @!), @SAVE and @LOAD. These commands can be entered from the keyboard or can actually be placed in Basic programs.

The @NEW command initializes and verifies the wafer by turning on the drive motor (right LED goes on) and searching the tape for the beginning-of-tape foil. When a sensor spots the silver foil on the tape, the left LED goes on and the Stringy writes on the wafer tape with a special code. The tape is a continuous loop — it pulls out of the center, goes past the recording/playback head, and then winds around the outside of the tape pancake, like the common 8-track music tapes you have in your car or home. You don't ever have to rewind — in fact, you can't. As soon as the beginning-of-tape foil is located, the left LED goes out, the unit



A single PC board in the Exatron Stringy Floppy drive unit contains the ROM and all the necessary electronics. Photo Courtesy Exatron Corp.

continues running, reading and verifying every non-byte on the entire tape! This assures you that the tape has no dropouts, snags, wrinkles or other nasty things.

Meanwhile, the screen says "ERASING . . . " (Shouldn't it say "VERIFYING"?) When the tape has been completely verified, the number of available bytes on the tape appears on the screen, followed by "DONE."

Saving A Program

The @SAVE command is similar to the cassette CSAVE command, and must be followed with a number from 1 to 99. 99? Yes, you can save up to 99 numbered programs on a single wafer. (You can do the same sort of thing on a cassette — in Level II, anyway — but who bothers? It takes so long for the tape, running at normal speed, to find the numbered program that everyone I know uses the tape counter and fast-forward manually.)

You must give the program a number, starting with "1" for the first program. The drive moves the tape forward until it finds the next available space. If you already have, say, two programs on that wafer, you would command @SAVE3. Once the tape has moved to the next available space, the record head writes the program, then the tape continues around and verifies with the computer every byte of the newly-written program before stopping.

In one operation you have accomplished what you usually do with a CSAVE, rewinding and a CLOAD? using a cassette.

Loading a Program

The @LOAD command is like the cassette CLOAD. If you don't follow with a number, it will load in the next program on the wafer. Give it a number, like @LOAD3, and it will seek and load that specific program only. Give it a number not existing on the tape and it will seek endlessly. (This wastes time but it is not otherwise harmful.)

The BREAK key stops the Stringy Floppy at any time.

You verify the loading two ways. The screen says "READING . . . " during loading and follows with "DONE" when completed. If there's an error, a "CHECKSUM ERROR" or "PARITY ERROR" will appear on the screen — rare, in my experience, and not likely to occur if you try again. The second verification of a good load is to LIST the program. I've never had a bad load when the screen said "DONE." What a pleasure compared to cassette loading in Level II.)

Timing Comparisons

Getting down to the nitty-gritty, I have a chart that shows the timing comparisons in loading several programs I use frequently (see Table II). The Amway Products Distributor Records program contains over 270 DATA statements (one for each of my distributors) and it needs to be updated every month. This used to be a real bother with cassettes, since every change required making a new cassette copy of the program, CSAVEd and verified twice. Each CSAVE or CLOAD? took over 4 minutes plus rewinding time. With the Stringy Floppy it takes under 45 seconds to @SAVE and verify —and I only have to do it once. That's over 16 minutes for cassette, versus under 45 seconds with the Stringy Floppy.

The Telephone Dialer Program is another example of how speed can be important. It offers the convenience of dialing numbers stored in memory — but can take several minutes to load if you have a lot of names in memory. With 67 names in memory it takes 86 seconds to load from a cassette, but only 6 seconds with the Stringy Floppy. Obviously, it gets used more often now than before I had a Stringy.

Data Handling

Some programs require data be stored outside of the regular program itself. Inventory, mailing lists, accounts receivable and many other data bases are usually handled this way. With cassettes it's a bummer. Loading external data into a program from a cassette, can take 30 minutes or more, since it's usually done line-by-line.

However, a special data I/O program is supplied for the Stringy Floppy. It lets you operate on 256 bytes at a time, with no serious loss of speed. The program occupies less than 1K and loads quickly from a wafer (taking about one second to load).

The data I/O wafer gives you four new Basic commands (see Table III). These are similar to cassette or disk file commands, and can be directed to any of up to seven Stringy Floppies on line. The special I/O commands are normally imbedded in Basic programs.

Table III. Data I/O Commands

@OPEN(n) — Open Specified Data File
@PRINT — Records Data on Wafer Tape
@INPUT — Reads Data Into Memory
@CLOSE — Closes Data File
(Note: @ May Be Shifted or Unshifted)

For example, I have an order checking program I use almost daily in my Amway business. It holds 260 DATA statements which are loaded into a two-dimensional, 6-column by 260-row array with READ statements in the program. Because the resident DATA statements take up about 6500 bytes of my 16K memory, I'm limited to 260 stock numbers and prices. Once the data items are loaded into the array by the program, the data is just occupying memory for no purpose. I found I could use a data cassette, but it took almost 30 minutes to load the data into the program. However, using the Stringy Floppy data I/O program, reading the data into the array from a wafer takes only 45 seconds and frees 6500 bytes of memory — which allows me to put almost 500 stock numbers and prices in an array instead of 260! Now that's what I call an improvement.

Tape cassettes are cheap and are really great for "archival storage"

Machine Language

You can also @SAVE machine language programs if you know the starting address and byte length. An autostart address is optional. A monitor wafer is available for machine language debugging; it includes a memory relocator and separate manual. Level III Basic is also available on a wafer.

Manual

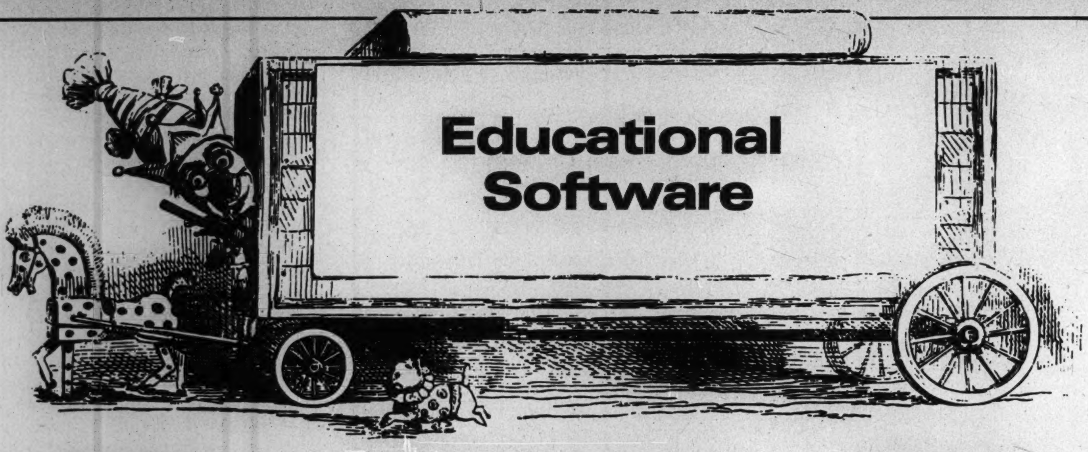
Although I've had no experience with disks or exotic peripherals, I followed the user's manual easily. It's so very explicit, with examples and explanation of error messages. It even has a selection on Assembly Language Operations for those of you who understand that stuff. And for the hardware types, a parts layout and complete schematic are also included.

Guarantee

Exatron sells the units with a 30-day unconditional moneyback guarantee. Besides the TRS-80, Stringy Floppies are available for the SS-50 and S-100 busses as well. The cost for the TRS-80 version is $250, with the other units comparable.

Exatron doesn't have any dealers, so you'll have to contact them directly. Their address is 3559 Ryder St., Santa Clara, CA 95051, and they have a hot-line toll-free number: (800) 538-8559, except in California, where the number is (408) 737-7111. □

Educational Software



Part One

David Lubar

Almost any use of the computer can be educational, even when instruction is not the main intent of the program. This tends to turn a review of educational software into a complex task of selection (in itself an educational experience). To narrow the field, the following types of programs will be considered: 1. Those labeled "Educational" by their manufacturers. 2. Those which, while not labeled "Educational," do provide the user with new concepts, new information, or new approaches to problem solving. With these criteria established, but not inflexibly fixed, we'll look at a variety of educational software for home computers.

Almost any use of the computer can be educational, even when instruction is not the main intent of the program.

Edu-Ware

Edu-Pak 1 from Edu-Ware ($39.95) is a disk for the 48K Apple II and Apple II-plus, requiring Applesoft in ROM. The disk contains five programs: "Compu-Read," "Perception," (three programs) and "Statistics." Each program allows for several options and variations, thus creating a large software library on a single disk.

"Compu-Read," designed to improve a reader's speed and retention, begins with a choice of six different programs. "Compu-Read I" places three random letters on the screen for a brief moment. The user must type these letters after they have vanished. If he succeeds, the next set of letters remains on the screen for a shorter period of time. If he is wrong, the time of display increases. At the end, the time of display is shown, as well as the number of letters per second for both the start and end of the segment. This information helps the user gauge his progress.

"Compu-Read II" uses words instead of random letters. At this stage, the skills developed in the first program are called into service. Skills related to recognition are also emphasized and strengthened in this exercise. "Compu-Read III" displays a word on the left and four words on the right. One of the four is either a synonym or antonym for the word on the left. Once again, the words do not remain on the screen for long. The user must type the correct synonym or antonym. This involves both recognition of the words and comprehension of their relationships. The system can train a person to absorb and analyze data in a rapid manner.

"Compu-Read IV" presents a sentence, then asks the reader a question concerning the sentence. The question is always about either the subject or object, thus training the user to scan quickly for information. This technique can greatly increase reading speed. The next two programs are file builders which allow the creation of new word lists for the second and third programs. The series is well developed and seems designed to build up reading skill in discrete segments. There are options to specify the number of trials and the length of time for display. Complete statistics are given after a round, breaking the performance into several factors such as percent correct, display time of first word, display time of last word and rate of letters per second.

Next on the disk is the "Perception" series. These three programs, in high-resolution graphics, test visual perception and the ability to judge spatial relations. "Perception I" concerns lengths of lines and gives a choice of 5 tests. In each, a line must be matched to a specific, illustrated length. The line is controlled with the paddles. The options include two vertical lines on the floor of a room and two crossing horizontal and vertical lines on the rear wall of a room. Anyone who is familiar with optical illusions will realize that finding a match is not always easy. The program responds to the user's guess with the percentage of error in the estimate.

"Perception II" deals with shapes. Again, there are a large variety of options. Basically, a shape with from three to eight vertices (user selects this number) is shown in sections as a window scrolls past it. The player must pick a matching shape. In "Perception III" the match must be made on the basis of size. The player selects from a choice of seeing the shape on a blank screen or against a scale which allows comparison. He also chooses from three ways of seeing the master and test shapes. The number of vertices in the shape and the time it is displayed are also controlled by the user.

Anyone familiar with optical illusions will realize that finding a match is not always easy.

These programs develop not only spatial perceptions but also concentration. And they are fun. With all the options and variations, anyone could use the "Perception" series for a long time without tiring of it.

The last selection on the disk is "Statistics." This contains six programs, including "Chi Square Distribution," "Mean, Variance, and Standard Deviation," and "T-Test."

The disk is well done. Each program is menu driven, and comes with complete instructions. A lot of thought went into *Edu-Pak I.* It would make an excellent addition to the software library of any school, and could be used by students of almost any age. The programs mentioned above are also available individually on cassette and disk. Edu-Ware has many

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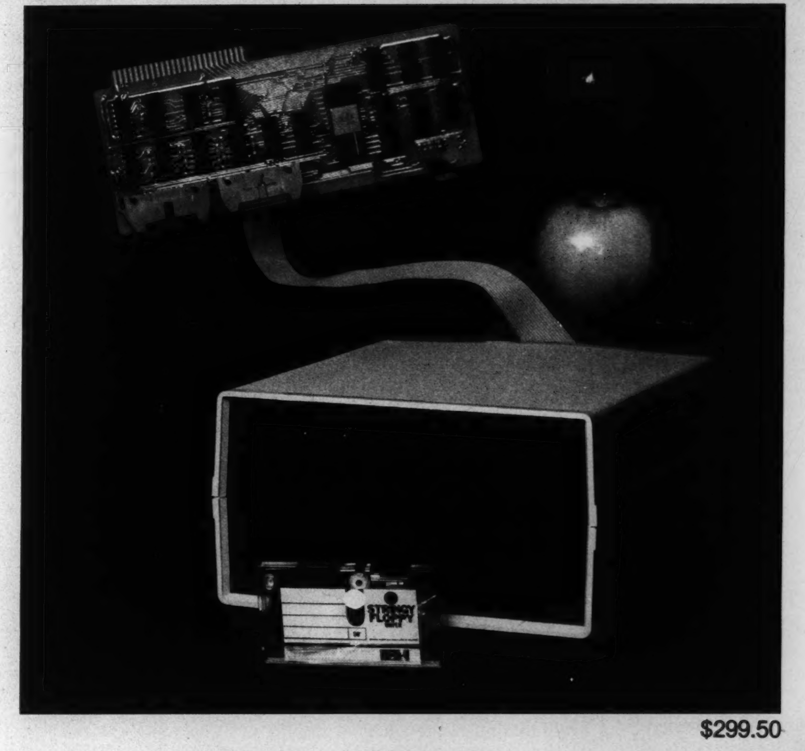

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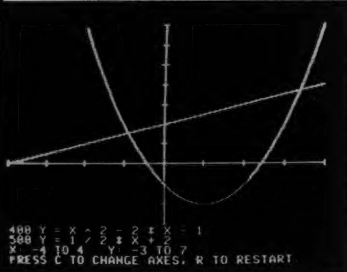

```
400 Y = X ^ 2 - 2 * X - 1
500 Y = 1 / 2 * X + 2
X: -4 TO 4   Y: -3 TO 7
PRESS C TO CHANGE AXES, R TO RESTART
```

PLOT

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Software, cont'd...

other educational programs (as well as some simulation programs) on the market and under development, and is also working on new versions of present programs. This process of revision insures a dynamic product. They combine talented programming with skilled educational techniques; the results are good.

Steketee Educational Software

Cassette TO 3 for the 16K TRS-80 ($9.95 + $1.00 p&h), from Steketee's *EDU-SOFT* series, contains two programs which can be used both in the classroom and at home, "Plot," and "Guess the Rule." "Plot" allows the graphing of single or simultaneous equations. Anything within the mathematical capability of the TRS-80, from a simple Y=X+2 to a complex Y=SIN(X)/X*SOR(X), can be used. An equation is entered by being placed in memory as line 400. A second equation can be inserted as line 500 if a graph of simultaneous equations is desired. Since these equations become part of the program, TRS-80 conventions for math symbols must be followed. Once an equation is entered, the user has a choice of either Cartesian or Trig coordinates, as well as a choice of any desired endpoints. If the selected endpoints are too small, the line won't appear on the screen. If this happens, larger boundaries are needed. After the function is graphed, it can be replotted with different endpoints, saved to be combined with the next equation, or deleted from memory. "Plot," which gives good visual representations of many concepts in Algebra and Trig, could be of value to almost any age group.

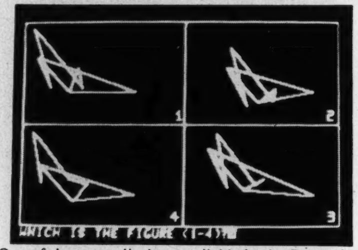
Both beginners and old pros will be fascinated by the internal view of a computer in action.

In "Guess the Rule," the computer selects an equation, ranging in difficulty from simple linear ones of the form Y=X+a to quadratics such as Y=aX + bX + c. The player is then shown two pairs of X,Y values. Using this information, he must determine the rule, either by guessing the equation or by supplying a correct pair of values for X and Y. Ten equations are presented in each contest.

Another cassette, *TO 4* (same price and configuration as *TO 3),* contains "Computa-Doodle" and "Simulated Computer." "Computa-Doodle," as the title suggests, is a graphics utility. The left, right, up and down arrows control a cursor which draws lines. An arrow followed by a number will give a longer line. Left arrow followed by "9," for example, will move the line nine spaces to the left, plus one for the move registered with the initial press of the arrow. The "Q," "W," "A," and "S" keys allow diagonal moves, with numbers following to give the degree of slope. Once a diagonal has been started, the slope can be changed just by pressing a different number. This allows smooth curves to be drawn. There is also a command which displays the numbers that represent the graphics in memory, and a command which moves the entire drawing on the screen. "Computa-Doodle" is well designed and easy to use.

"Simulated Computer" is an excellent program. It turns the TRS-80 into a microprocessor. Twenty memory locations (little boxes) are displayed on the screen, along with boxes for input, output, accumulator, program counter and instruction register. A group of three digit commands, for such functions as "add," "subtract," and "skip," is used to program this simulation of a computer. Once a program is entered, the operation of this "central processing unit" is graphically displayed as the user sees memory contents change and as input and output appear in the boxes. There are also modes for slowing the program, and for running in single steps. The program is a great introduction to the concept of a microprocessor. Both beginners and old pros will be fascinated by this internal view of a computer in action. "Simulated Computer" is a good first step on the way to understanding a Z-80 or a 6502 microprocessor.

Steketee programs come with good documentation, including complete instructions and suggestions for using the programs. The programs are well designed for ease of operation and contain many error traps. This cassette can definitely be used in the classroom. Individual users can also enjoy this tape. Any of Steketee's tapes can be ordered on disk for an additional $5.00.



```
WHICH IS THE FIGURE (1-4)?
```

One of the many displays available in the Perception series from Edu-Ware. Here, the player must match the shape he saw earlier with one of the four now shown.

Basics and Beyond, Inc.

Microcosm I for the Level II 16K TRS-80 ($19.95) contains thirty programs on two cassettes. The programs range from games and simulations to utilities and educational aids. The games are nice,

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Compu-read	**48K, disk only 24.95**
Perception	**48K, disk only 19.95**
Statistics	**32K, cassette 9.95, disk 15.95**
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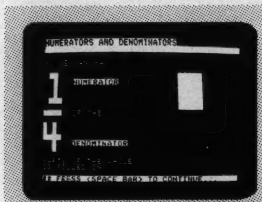

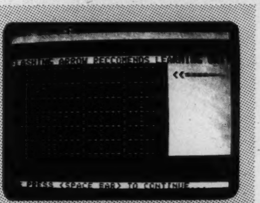
FLASHING ARROW RECCOMENDS LEA
<<
PRESS <SPACE BAR> TO CONTINUE...

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Software, cont'd...

though some are reminiscent of previously published ones. Several of the games could be considered educational. "South Pole" allows one or two players to try to reach the pole and return. The players decide how many men and dogs to bring, and how much food and fuel to take along. Daily reports are given as the players pick their routes toward the pole. Aside from a rather long wait while data is being displayed, the game is fun. More varied and complex is "Atlantis." Here, the player must decide on a course of action to save this mythical island from impending doom. He can try to build a dome for protection against the volcano, work toward evacuation, or try one of several other approaches. Many decisions are involved, with many possible outcomes. This is a nice simulation.

Then there are the educational programs. "Country Guess" has the player choose a country. The TRS-80 asks questions until it is able to name the country. This requires the player to know (or learn) a fair amount of Geography; otherwise he won't be able to answer correctly. "Math Table Drill" allows the user to select the number he wishes to study. The computer than presents problems in basic arithmetic which involve the number. This could be a good way to practice multiplication tables. "Spelling Drill" flashes a word on the screen, then waits for the user to spell the word. Any mistake will immediately end the attempt, but another chance will be given. "Spelling Review" allows the user to enter his own list of words for review. There are three levels, each presenting the word for a different period of time.

Microcosm I also contains data-base type programs such as "Flowering Houseplants," "Calories-Food," and "Calories-Ingredients," as well as programs for balancing checkbooks and checking memory. At this price, it is a worthwhile purchase. Included with the cassettes is a 24 page booklet which gives detailed rules for the games and background on the educational programs. The tapes and booklet are attractively packaged in a sturdy plastic binder.

Educational Activities, Inc.

This company markets several programs for the PET and TRS-80. Apple II-plus versions are also in the works. *Missing Facts* ($29.95) can be used by a student with no help from a teacher; the instructions are clear and simple. As in "Math Table Drill" (see above), problems are presented with one missing factor — 5+?=9 — and the user has to supply this missing number. After a correct answer, the whole problem is displayed again. When the guess is incorrect, three chances are given before the computer provides the answer.

Flash Spelling ($14.95) presents words one letter at a time in large script. The whole word remains on the screen for an instant, then vanishes. At this point, the user must correctly spell the word. While there might seem to be no challenge in spelling a word that has just been on the screen, the benefit of this program is that it reinforces learning. By seeing the word one letter at a time, the student is more likely to remember the correct spelling.

"South Pole" allows one or two players to try to reach the pole and return.

Scrambled Letters ($14.95) is for two players, who take turns trying to solve jumbled words. If a player is correct, his opponent gets a new word; on an incorrect guess, the other player gets a shot at the same word. If they both miss twice, the program shows them the word. Extra points are given for speed in this contest. There is only one small problem. Some words, such as "ocean," have anagrams. A player who responded to "aceno" with the answer "canoe" would be told he was wrong. Aside from this, the program is well designed.

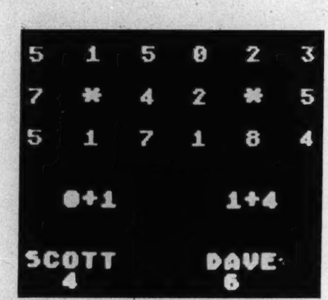
Introduction to Mathematics on the Computer ($29.95) is a marvelous, wide-ranging program. It presents the student with math problems at a specific selected level of difficulty. If the student does well, the level increases. The value of the program becomes apparent when the student makes a mistake. After several tries, if the answer hasn't been found, the machine restates the question as a word problem. Instead of using "5+3," for example, it says, "Maybe this way would be easier for you: If I had 3 pencils and you gave me 5 more, how many pencils would I have?" The program is also extremely patient when trying to get answers to yes/no questions during the inital set-up. This is a nice touch, and shows the care that went into the package.

Programs from Atari represent a good concept which has produced fair to excellent applications.

Most of the EA programs make extensive use of large-size letters. The documentation consists of only an insert in the cassettes, but it provides information on changing the data bases for the spelling games, and advice on what to do when problems are encountered. Besides, the programs contain everything the user would need to know. These tapes could be of value in the classroom, and could also be used by students who want to learn on their own, or who need extra help with a subject. This is definitely a quality product line.

Image Computer Products

Now that the Atari home computer has been on the market for a while, other companies are beginning to produce software for it. Image has brought out a nice cassette, *Skill Builder I* ($19.95), containing two educational programs for younger persons. Running on either the 800 or 400, "Number Hunt" has the player move from the center to the edges of a three-by-three grid, trying to find the number that matches the answer to a problem shown at the bottom of the screen. At first, the problems are very simple. If the player does well, the problems become more difficult. A single player can use the program, or two players can compete, trying to be the first to find the number. In the two player version, each player has his own grid. The control is through joysticks.



```
5   1   5   0   2   3
7   *   4   2   *   5
5   1   7   1   8   4

  0+1         1+4

SCOTT       DAVE
  4           6
```

Two players try to find the right answers in Image's Number Hunt. The game adjusts for different skill levels.

The same cassette also contains "Bingo Duel." In this game, numbers must be found on a five-by-five grid. Two players can compete, each getting a different level of problems but using the same grid, or the game can be used by a single player. Both games are well explained in the booklet accompanying the cassettes. These programs could be used by children who are learning their numbers or who are learning elementary addition and subtraction. Older children might also enjoy the competitive aspects of the games.

Atari

The *Talk and Teach* programs from Atari represent a good concept which has produced fair to excellent applications. Using the Educational System Master Cartridge, the machine comes on with simple instructions for loading the cassette. After the program is in memory, the computer controls the tape, which gives audio output through the television to supplement the information on the screen. For some applications this is a nice idea. The Sociology set, with sixteen

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On Computing, Summer 1980

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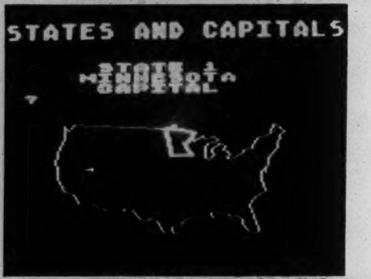
CIRCLE 194 ON READER SERVICE CARD

Software, cont'd...



Having guessed the state, the player of Atari's States and Capitols must now give the capitol.

programs on four tapes, is well done. The first program introduces the topic, explains what will be covered, and begins to give a background of basic concepts. As text is displayed on the screen, a narrator repeats the material. Since speech can be faster than reading, the voice is able to give extra information.

Throughout the program, the tape stops and a question appears on the screen, along with two or three possible answers. If the wrong answer is selected, there is a buzz. When the right one is found, the tape continues, often making a comment about the answer.

In the same series is a set of History tapes. These begin with the Greeks and move chronologically forward. The history lessons stress a cause-and-effect approach. Obviously the tapes took the efforts of three professionals; a programmer, an educator and a trained speaker. The lessons are put together with great care for detail, accuracy and interest. The use of text and graphics is well done, and learning from these tapes is a painless endeavor.

There are times when something is used because it is available, not because it is the best thing to use. This could be the case with the *Great Classics* selection of the *Talk and Teach* series. Each story is presented in synopsis with a style reminiscent of *Classics Illustrated.* The program pauses to ask questions, insuring that the reader grasps the plot line, but that isn't enough. The value of literature comes not from the plots, which are often ancient and borrowed, but from the way words are put together. None of the works in this sixteen-story collection, from *Julius Caesar* to *A Tale of Two Cities,* can be viewed as anything but story line. Each work is a classic because of the style and art of the writer. These tapes are pale images of the classics. If they interest a student enough to get him to read the originals, fine; but that doesn't seem likely.

Also from Atari is *States and Capitols* ($14.95). A high-resolution map of the USA is displayed. One at a time, the states are outlined. The player has to guess the state. If he is wrong, the program will tell him the answer. After that, he has to guess the capitol. Again, the correct information is provided after each guess. The game is nicely designed, but would be best used in a classroom, since individuals who used it would quickly learn the states and have no more need of the program.

Creative Computing (Sensational Software Division)

This review would not be complete without mention of some of the newer educational programs from *Creative Computing.* First, for the TRS-80, is *Ecological Simulations - 2* ($14.95). This contains four programs: "Pollute," "Rats," "Malaria," and "Diet." In "Rats," the player tries to control a population of rats, using various poisons. He can select the length of time between reports, as well as the length of each application and weight of the poison. Trying different methods, the player learns the results of combination programs using varying amounts of poisons.

"Malaria" is a varied and interesting program. The player must select from several measures designed to limit the spread of a malaria epidemic. Attention must be split between preventative and curative measures. At the end of a round, the player is given an evaluation of his work, showing how effective each of his measures was. Bit by bit, it is possible to develop a strategy which makes the most effective use of the various measures. This game quickly becomes absorbing.

The value of literature comes not from the plots, which are often ancient and borrowed, but from the way words are put together.

"Pollute" takes the user's selection of water temperature, kind of waste, rate of dumping, and treatment method, then shows the effects on a body of water. It contains good error traps and other aids. In entering the amount of waste, a reply that is way too large will result in the comment: New York City has a rate of only 12 parts per million per day. The display graphs oxygen against waste in the water. This program, too, is a good learning tool.

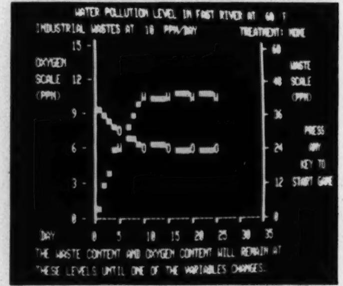
The final simulation, "Diet," allows experimentation with various weekly diets, without the risk entailed from actual experiment. A player can learn what a week of milkshakes would do to him, or a week of sprouts and other vegetables. The output tells how much weight would be gained or lost on this diet, as well as the nutritional makeup of the food.

In these programs, a reply of "-1" as input is used whenever the player needs help in answering a question. The documentation includes detailed explanations of all parameters and variables, as well as exercises to get the user started and advice for classroom activities with the program. Also included is information on the assumptions made in the simulation. The manual itself can be an educational tool.

Another tape from *Creative Computing, CAI-2* ($11.95), is for a 16K Apple II with Integer Basic. It contains three programs designed for computer-assisted instruction. "European Maps" begins with a high-resolution display of Europe. The player is given the choice of naming either countries and capitols or just countries, as well as the option of just entering the first letter of the name of the country. During the game, a dot in the center of one of the countries will begin to flash. The player must name this country. If he is wrong, he will be given the same country twice more at other times during the game. This use of graphics for visual learning is nice, and should produce good results.

"Meteor Math," for beginning and intermediate students of math, takes the pain out of arithmetic. The player is informed of a meteor which is falling toward Earth. He must destroy the meteor with his laser cannon. But he has to answer math problems correctly before he can fire the cannon. It takes a lot of shots to destroy the meteor. If the student does well, the level of difficulty of the problems increases. This is a nicely-designed package which makes good use of graphics in presenting math problems.

The tape also contains "Music Composing Aid," which allows the entry of notes, the replay of the notes or of other saved scores, and the editing of compositions. The music, coming from the Apple's own speaker, sounds like an alto recorder. When using the system for composition, each note is played as it is entered. Notes are coded using a simple method. A C below middle C is entered as C. To go an octave higher, the composer would use CC. There is a range C below middle C to C three octaves above middle C. Along with the program is a data tape containing a Bach composition. The program encourages students to learn musical notation so they can transpose their favorite scores


WATER POLLUTION LEVEL IN FAST RIVER AT 60 F

INDUSTRIAL WASTES AT 10 PPM/DAY TREATMENT: NONE

THE WASTE CONTENT AND OXYGEN CONTENT WILL REMAIN AT THESE LEVELS UNTIL ONE OF THE VARIABLES CHANGES.

A graph of waste particles and oxygen is given in Pollute from Creative Computing. Players can try various means of raising the oxygen and limiting waste.

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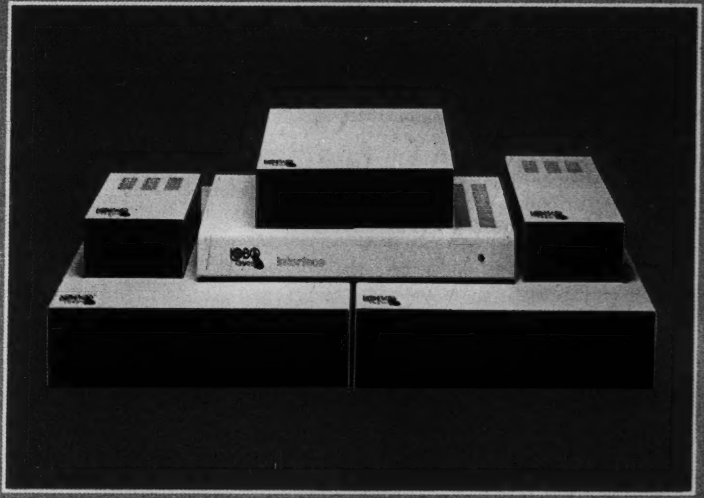

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CIRCLE 204 ON READER SERVICE CARD

Software, cont'd...

from sheet music into computer data. This package offers a nice variety of programs, and would be worth the price for the music routines alone.

Moving away from educational software, we get to those programs that are intended as aids for teachers. Generally, such programs are concerned with organizing data, and with saving time. First, two cassettes from Educational Associates; one very good, one fairly disappointing. The good cassette, *Readability Index* ($9.95), can be useful not just to teachers but also to those who work in children's literature; especially literature for the high-interest low-readability field. Readability gives a guideline for determining what material can be comprehended by what grade level. In the EA program, the user enters three paragraphs; the first, one from the middle, and the last. The program then gives word count, sentence count, the number of letters, the average length of a word, the percentage of the words that are on the Dale readability index, and the readability level. The Dale long list contains words that are in the vocabulary of readers at certain ages. The percentage given is an estimate; an actual check against the list would take too much time. Along with the printout is a chart for finding the grade level that is appropriate to the readability. This program is useful and well set up for ease of operation.

Considering the overall quality of EA software, their *Grade Averager* ($9.95) is a disappointment. The program allows entry of grades, either letter or numeric, for each student in a class. When all the grades have been entered for a student, an average score and letter equivalent are given. At the end of the program, a summary of all names and averages is furnished. So far, no problem. But the program does have flaws.

A player can learn what a week of milkshakes would do to him, or a week of sprouts and other vegetables.

First, once a grade is entered, it is there for good. There is no way to edit mistakes. Any change would entail redoing the whole file for that student. Also, a wrong entry that is a letter other than "A," "B," "C," "D," or "F" is taken as a signal that the entries for that student are finished. It seems that this cassette could create more work than it saves.

The *Apple II Gradebook* ($24.95) from *Creative Computing* is a disk-based utility that allows teachers to set up files containing the names of students and their scores. The user first establishes a roster by entering the names of the students. More than one class can be held on a disk. Once a roster is on file, it can be accessed to add new scores, change scores, change existing information, or add information.

A lot of thought seems to have been devoted to making this program easy for the user. After a name has been entered, the computer shows the name on the screen and asks if it is correct. Getting a "yes," the name is put on file. If the name isn't correct, the computer asks for another entry. This method should virtually eliminate user errors.

In "Rats," the player tries to control a population of rats, using various poisons.

With names and scores on file, it is possible to get various statistics from the system, such as scores and averages for each student, as well as his deviation from the mean. Another nice touch: the names can be entered in any order. When they are sent to disk, they will be stored alphabetically. This system is very easy to use. Anyone who can type can have the luxury of a computer grade book. The documentation covers use of the system and recovery from any problems that might be encountered (such as accidentally hitting reset).

As should be obvious by now, there is a lot of educational software out there, and the quality seems to be getting better every month. With careful shopping, any school or individual should be able to fill all software needs for a reasonable price. ☐

Vendor Addresses

Atari Inc.
1265 Borregas Ave.
P.O. Box 9027
Sunnyvale, CA 94086

Basics & Beyond, Inc.
Box 10
Amwalk, NY 10501

Creative Computing
P.O. Box 789-M
Morristown, NJ 07960

Educational Activities, Inc.
P.O. Box 392
Freeport, NY 11520

Edu-Ware Services, Inc.
22035 Burbank Blvd. #223
Woodland Hills, CA 91367

Image Computer Products, Inc.
615 Academy Drive
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Steketee Educational Software
4639 Spruce St.
Philadelphia, PA 19139

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Apple vs IBM

IBM/370 users have VSAM (Virtual Storage Access Method) to provide fast, flexible keyed-access to their data. Now KRAM (Keyed Random Access Method), from United Software of America, gives APPLE users the same flexibility, substantially increasing the processing power of the APPLE.

Until KRAM, the only "random access" capability in the APPLE consisted of a crude form of "relative record" processing. While this is usable for very simple applications, it falls far short of the needs of today's business & analytical applications. Using KRAM, records may be processed by a "key" value, which may consist of any kind of data: numbers, letters, special characters, etc. Even APPLE's long-awaited DOS 3.3 doesn't have anything like this!!

Just compare: Consider an employee file in a Payroll application:

FUNCTION	APPLE'S DOS 3.3 RANDOM ACCESS	KRAM	FEATURES
Retrieve by Social Sec. #	NO	YES	Relative record is limited to 7 digit #'s; KRAM keys up to 48 bytes!
Retrieve by Last Name	NO	YES	Relative record cannot file alphabetically
Erase a record	NO	YES	Relative record cannot erase records
Dynamic record allocation	NO	YES	KRAM files grow as needed
Dynamic compression	NO	YES	KRAM recaptures space when records are deleted
Mutliple files open	NO	YES	KRAM can keep 5 files open simultaneously
BEST WAY	NO	YES	It's obvious

As you can see, KRAM now attains levels of sophistication on the APPLE that rival those of IBM mainframes. . . So why let the IBM users have all the power? Power up your APPLE with KRAM!

KRAM RELEASE 2.0 FUNCTIONS:

- *Create/Open a dataset*
- *Put record by key*
- *Add & Delete records by key*
- *Get any record by Full or*
- *Partial key in .4 sec.*
- *(.2 sec. with Corvus Disk)*
- *Supports multiple disks*
- *Read next or previous record*
- *Dynamic space allocation*
- *Dynamic space reclamation*
- *Dynamic index compression*
- *Never needs reorganization*

An 80 page manual fully documents KRAM 2.0 functions and illustrates with programming samples. KRAM architecture is fully explained and a sample mailing list application program is included.

APPLE & PET Requirements:

KRAM is designed to work with both APPLE's Disk II and Corvus Systems 10 Megabyte Winchester Disk, and Commodore's 2040, 3040, and 8050 Disk units. KRAM 2.0 requires 32K/48K APPLE with Integer Basic in ROM (compatible with APPLESOFT) and at least one disk drive. KRAM works on any 40/80 column 16K/32K PET.

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MUSIC & GRAPHICS

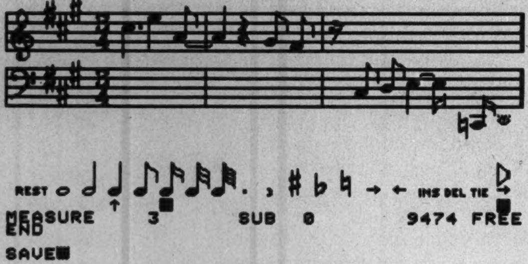
ALF Music Synthesizer

The ALF music synthesizer has three voices on each board which are easily programmed using the Entry program provided. The envelope shape of each voice (or even each note) may be controlled individually thus allowing the synthesis of practically any instrument such as a violin, trumpet, piano, harp or bells. Instrumentation and dynamics may be varied while a song is playing by changing the attack, sustain, release, decay, gap and volume of the notes.

Playback of music is accompanied by a spectacular color display showing a stylized "piano keyboard" for each part with the colors of the notes varying in proportion to their loudness and waveform.

Ease of Music Entry

Music is entered directly using the high-resolution graphics entry program. One paddle is used to select menu items such as note duration, accidentals, dotted notes, triplets, tied notes, etc. while the other paddle moves a note cursor up and down the staff over a 4-octave range. The transpose command extends the range to eight octaves. This form of music entry is considerably faster and more accurate than cryptic note code schemes (like QFS3) found with other synthesizers.



MUSIC ENTRY SCREEN

The board plugs into any Apple II or Apple II Plus. Two or three boards are required for stereo. Requires a 16K Apple system and external amplifier and speakers.

***ALF Apple Music II (AM-II) Synthesizer**

The AM-II is a new, low cost digital music synthesizer for the Apple II computer. It features 9 voices on a single music card.

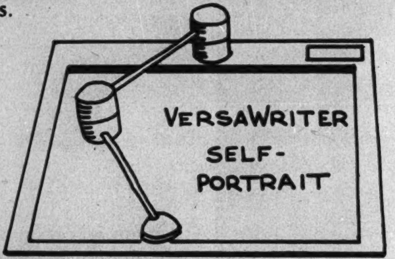
The software ENTRY and PLAY systems are the same as on the ALF Apple Music Synthesizer (AMS). The two principle differences between the new AM-II and the original Apple Music Synthesizer are in pitch range, volume range, and parts per board.

The new AM-II has a range of six octaves. The dynamic range is 28 db. (The original AMS has a range of 8 octaves a dynamic range of 78 db and 3 parts per board.)

VersaWriter

VersaWriter is a drawing tablet for the creation of full-color, high resolution graphic images on the Apple. Images may be drawn freehand or traced from existing images (cartoons, photos, drawings, etc.) using the simple pivoted two-arm pantograph with magnifying crosshairs.

After an image is drawn, it may be rotated, shrunk, or enlarged. It may be moved across the screen and alternated with other images thus providing high-resolution animation. The image may be colored with varied colors.



Animate other Programs

Graphical images made with VersaWriter and stored on tape or disk may be called from other programs or even imbedded in them. With VersaWriter, you don't have to worry about assembly code, counting pixels or other cumbersome hi-res graphics entry and retrieval techniques.

VersaWriter graphics can be used in all types of programs—games, statistics, engineering, artistic, and educational. Your only limit is your own imagination.

Two Disks of Software

Disk 1 contains the basic plotting, scaling, movement, rotation, color, transfer and recall software. This disk also includes routines which create "shape tables" from your figures to be used in other programs. Disk 2 contains applications software. One program adds five sizes of upper and lower case text to drawings, another adds standard electronic and digital symbols, while a third calculates distances and areas.

VersaWriter requires a 32 or 48K disk system, Applesoft in ROM or an Apple II Plus.

VersaWriter	$252.00
ALF Music Synthesizer	$268.00
AM-II Synthesizer	$198.00

Prices postpaid in USA. NJ residents add 5% sales tax.

To order VersaWriter or the ALF Synthesizer, send your name and address along with a check or chargecard number and expiration date. Visa, MasterCard and American Express are welcome. Units are in stock and orders will be shipped as soon as your check clears or your credit is verified.

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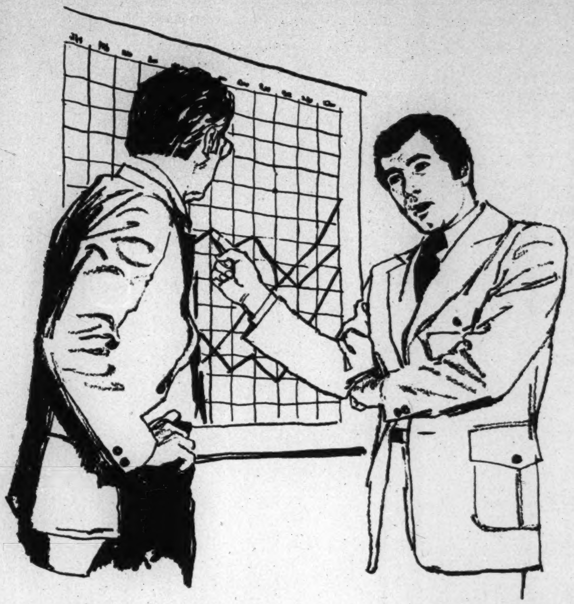
CIRCLE 207 ON READER SERVICE CARD



Stocks and Listed Options

Part 5 — Portfolio Records and Program PORTVAL

Alfred A. Adler, Ph. D.

The Series Thus Far

The first article of this series was introductory. The stock market was presented as the meeting place for buyer and seller or their representatives. Brokers were discussed as the usual form of representative, and the necessity for including the ever-present commissions in all calculations was discussed at some length. Some of the possible varieties of investment attitudes were touched on briefly. This was followed by a discussion of puts and calls, the listed option markets, and one or two of the more obvious option strategies.

The second article continued the discussion of option strategies with a brief presentation of the six basic maneuvers. Program OPGRAPH was then presented and discussed followed by sample runs illustrating combination strategies; with covered and uncovered calls, and covered and uncovered straddles receiving fairly detailed treatment.

Part 3 continued with more details on call writing followed by a fairly detailed discussion of opening versus closing option transactions. Program OPTION was presented along with sample runs covering hedging with calls, out-of-the-money hedges, and in-the-money hedges.

In Part 4, presented last month, a technique was discussed for predicting future option premiums. This method requires the establishment of a data base of historical option premiums in whatever detail the user desires. A pair of algorithms then utilizes this data base to project future premiums at whatever time and future stock price the user selects. Program NEWPREM was presented as the vehicle for this technique.

Market Timing and Progress Records

Having discussed the subject of buying and selling puts and calls in general, selling calls in whatever ratio against a long stock position in some detail, and finally the question of premium prediction, the subject of stock price prediction, otherwise known as market timing, begs to be addressed. A considerable degree of success has been achieved with Fourier transform methods and a form which is able to pick out the important stock price fluctuation frequencies is being written but is not expected to be completed and adequately tested for several months. That being the case, we must conclude this series with a discussion of a program that assists the user in keeping a readily available and easily updatable record of his portfolio and at the same time in measuring his progress toward financial success.

The serious investor tries not to make the same mistake more often than necessary.

Portfolio Records

The IRS, bless them, require that investors in common stocks file a Schedule D each year. This fascinating document requires a statement of the date and cost of acquisition as well as the date and proceeds of disposition of each stock and option position. An ongoing set of records is obviously required which, at the very least, keeps track of the contents of the portfolio and the acquisition conditions.

The serious investor tries not to make the same mistake more often than necessary. This requires historical records which can be referred to when necessary and reviewed periodically to continually refresh the memory regarding past successes and failures and the events leading to them. Only by keeping the past alive can one profit from his experience. In addition, simple curiosity should motivate an investor to keep a record of his performance, by the position, by the year, or whatever, if for no other reason than to assure himself that he would not be better off with his money in a savings account. Clearly, the records required to satisfy all these diverse needs have a high degree of commonality.

Program PORTVAL

The record needs imposed by Schedule D are automatically satisfied since we must start with these data in any event. The second and third requirements are easily met by trivial manipulations.

The portfolio itself is contained in DATA statements within Program PORTVAL itself. It turns out to be quicker and easier to do it this way than to use data files which must be constantly revised and updated. In the case of stocks the DATA statements contain the number of shares, the symbol of the stock, and the cost. The

---

Alfred A. Adler Ph.D., 10360 E. Flintlock Trail, Tucson, AZ 85715.

Stocks, cont'd...

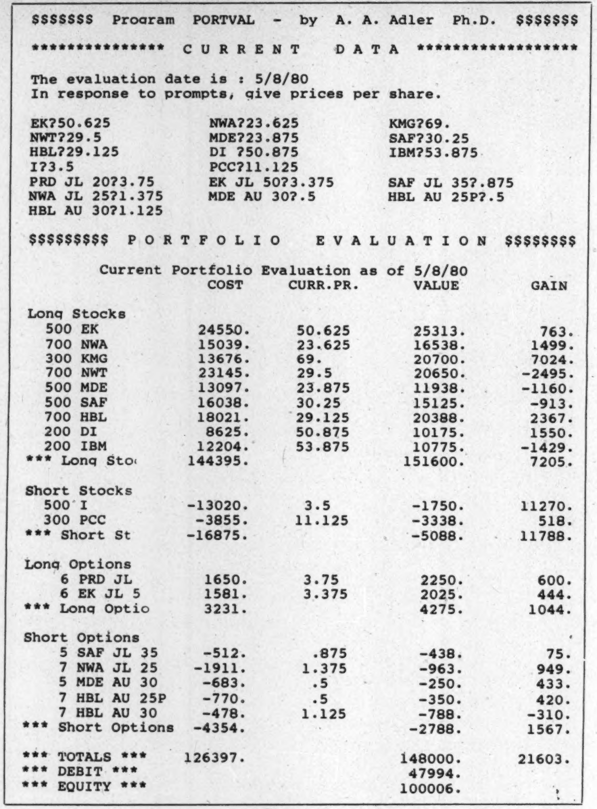
data of acquisition has been dropped due to lack of space and lack of interest. It is only needed once (when the stock is sold) and needn't be carried, possibly for years, in the interim. Keeping the 'buy' confirmations of current positions separately is sufficient and not too inconvenient. In the case of options, the DATA statements contain the number of options, the symbol of the underlying stock along with the expiration month, the exercise price and a 'P' if a put, and the cost. These DATA statements are divided into four groups: Long Stocks, Short Stocks, Long Options, and Short Options. In addition, the margin debit is recorded.

> **The user must keep a readily available and easily updatable record of his portfolio and at the same time measure his progress toward financial success.**

Following the run command the user will be asked to specify the evaluation date. The program will then list the stock and option symbols in order, pausing after each to permit the user to enter the current per share price. When these entries have been completed, a portfolio evaluation will be displayed. This consists of the portfolio information from the Long Stocks section of the DATA statements, followed across by the cost of the position, the current per-share price from the input data, the present value of the position, and, finally, the gain or loss in the position. This is repeated for each stock held long. When all the Long Stocks have been presented, subtotals are given for the cost, present value and gain. The Short Stocks are then presented in the same way, followed by the Long Options and the Short Options. When the entire portfolio has been presented, grand totals are given for the cost, present value and gain. Lastly, the DEBIT balance in the margin account is subtracted from the current value giving the net EQUITY.

Program PORTVAL, along with OPGRAPH, OPTION and NEWPREM, already presented, is available on cassette for TRS-80 16K Level II from *Creative Computing Software.* They are also available from the author on disk in North Star Basic, single or double density, and on cassette or disk in Applesoft.

Each of these programs has provision, not mentioned previously, for



```
$$$$$$$ Program PORTVAL - by A. A. Adler Ph.D. $$$$$$$

*************** C U R R E N T   D A T A ******************

The evaluation date is : 5/8/80
In response to prompts, give prices per share.

EK?50.625            NWA?23.625           KMG?69.
NWT?29.5             MDE?23.875           SAF?30.25
HBL?29.125           DI ?50.875           IBM?53.875
I?3.5                PCC?11.125
PRD JL 20?3.75       EK JL 50?3.375       SAF JL 35?.875
NWA JL 25?1.375      MDE AU 30?.5         HBL AU 25P?.5
HBL AU 30?1.125

$$$$$$$$$ P O R T F O L I O   E V A L U A T I O N $$$$$$$$

        Current Portfolio Evaluation as of 5/8/80
                   COST      CURR.PR.       VALUE         GAIN

Long Stocks
  500 EK          24550.     50.625         25313.         763.
  700 NWA         15039.     23.625         16538.        1499.
  300 KMG         13676.     69.            20700.        7024.
  700 NWT         23145.     29.5           20650.       -2495.
  500 MDE         13097.     23.875         11938.       -1160.
  500 SAF         16038.     30.25          15125.        -913.
  700 HBL         18021.     29.125         20388.        2367.
  200 DI           8625.     50.875         10175.        1550.
  200 IBM         12204.     53.875         10775.       -1429.
*** Long Sto     144395.                   151600.        7205.

Short Stocks
  500 I          -13020.      3.5           -1750.       11270.
  300 PCC         -3855.     11.125         -3338.         518.
*** Short St     -16875.                    -5088.       11788.

Long Options
    6 PRD JL       1650.      3.75           2250.         600.
    6 EK JL 5      1581.      3.375          2025.         444.
*** Long Optio     3231.                     4275.        1044.

Short Options
    5 SAF JL 35    -512.      .875           -438.          75.
    7 NWA JL 25   -1911.     1.375           -963.         949.
    5 MDE AU 30    -683.      .5             -250.         433.
    7 HBL AU 25P   -770.      .5             -350.         420.
    7 HBL AU 30    -478.     1.125           -788.        -310.
*** Short Options -4354.                    -2788.        1567.

*** TOTALS ***   126397.                   148000.       21603.
*** DEBIT ***                               47994.
*** EQUITY ***                             100006.
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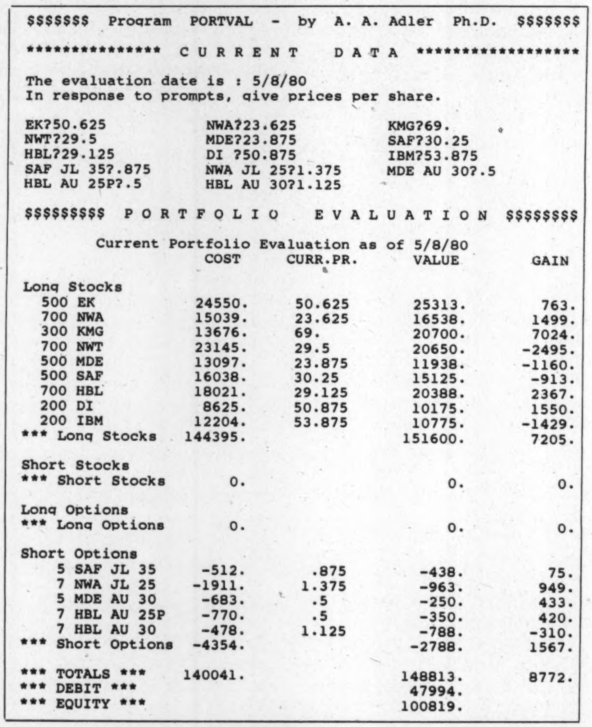
Figure 1



```
$$$$$$$ Program PORTVAL - by A. A. Adler Ph.D. $$$$$$$

*************** C U R R E N T   D A T A ******************

The evaluation date is : 5/8/80
In response to prompts, give prices per share.

EK?50.625            NWA?23.625           KMG?69.
NWT?29.5             MDE?23.875           SAF?30.25
HBL?29.125           DI ?50.875           IBM?53.875
SAF JL 35?.875       NWA JL 25?1.375      MDE AU 30?.5
HBL AU 25P?.5        HBL AU 30?1.125

$$$$$$$$$ P O R T F O L I O   E V A L U A T I O N $$$$$$$$

        Current Portfolio Evaluation as of 5/8/80
                   COST      CURR.PR.       VALUE         GAIN

Long Stocks
  500 EK          24550.     50.625         25313.         763.
  700 NWA         15039.     23.625         16538.        1499.
  300 KMG         13676.     69.            20700.        7024.
  700 NWT         23145.     29.5           20650.       -2495.
  500 MDE         13097.     23.875         11938.       -1160.
  500 SAF         16038.     30.25          15125.        -913.
  700 HBL         18021.     29.125         20388.        2367.
  200 DI           8625.     50.875         10175.        1550.
  200 IBM         12204.     53.875         10775.       -1429.
*** Long Stocks  144395.                   151600.        7205.

Short Stocks
*** Short Stocks      0.                        0.           0.

Long Options
*** Long Options      0.                        0.           0.

Short Options
    5 SAF JL 35    -512.      .875           -438.          75.
    7 NWA JL 25   -1911.     1.375           -963.         949.
    5 MDE AU 30    -683.      .5             -250.         433.
    7 HBL AU 25P   -770.      .5             -350.         420.
    7 HBL AU 30    -478.     1.125           -788.        -310.
*** Short Options -4354.                    -2788.        1567.

*** TOTALS ***   140041.                   148813.        8772.
*** DEBIT ***                               47994.
*** EQUITY ***                             100819.
```

Figure 2

Stocks, cont'd...

scroll control in the event that a hard-copy device is not available. In each case the user is asked whether or not printer copy is desired. If not, scroll control is invoked, which prevents the data from flying past the user. Since remarks such as PRESS RETURN TO CONTINUE are not highly desirable on printer copy, they are suppressed in that case. All sample runs presented in this series have been made with scroll control turned off.

Only by keeping the past alive can one profit from his experience.

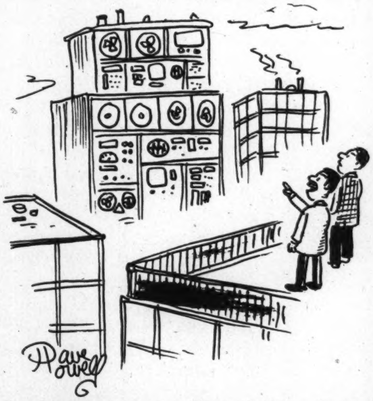
Sample Runs

To demonstrate program output, two sample runs are shown. Figure 1 illustrates an evaluation of a portfolio containing every possible type of position, long and short, stocks, puts and calls. Figure 2 shows an evaluation of the portfolio of a more conservative investor. There are no short stock positions and no long option positions. Note that the absence of such positions causes the program no problem.

Conclusion

Records must be kept, if only for stock records. In order for the investor to continually improve his performance it is necessary for him to periodically refer to past performance, and this also requires records. Finally he should constantly be evaluating his performance to assure himself that he is playing the right game.

Program PORTVAL meets these requirements while putting very little more load on the investor than tax record keeping already does. ☐



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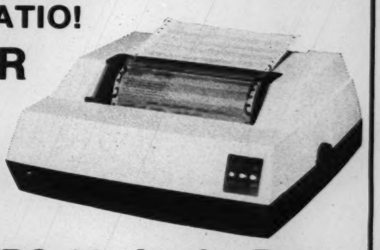

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See How They Run

David Lubar

I watched a TV program about computers yesterday. The show wasn't on Public Television, and it wasn't on cable. It was on video tape, and it was pretty good. Coming from Electronic Data Systems Corporation (EDS Center, 7171 Forest Lane, Dallas, TX 75230), the set of eight video cassettes contains a complete introductory course to small computers. Titled *Little Computers . . . See How They Run,* the tapes are hosted by a trio of beings; a nameless narrator, who is pleasant and articulate, an electronic mouse named Mike, who does little except run around, and an admittedly-fake computer named EV 1, who resembles a modern lamp. The tapes form a progressive course, starting out with an introduction, "Meet the Computer," which introduces the viewer to a number of popular home computers, including the Apple, TRS-80, CBM and Atari. Before long, the topic eases painlessly into such areas as memory organization, types of memory and bus structure.

Nothing is treated as lofty, holy or incomprehensible. The narrator keeps the same casual manner whether explaining how a cassette tape works or detailing the pin structure of a Z-80 microprocessor. The second tape, "Inside the Computer," goes more deeply into the workings of the central processing unit, and also covers ways that programs are handled once they are inside computers. Compilers and interpreters are explained and compared in this segment.

Throughout the program, visual aids are used — both computer-generated graphics and simple illustrations and charts. Tape 3, "CPU and Memory," breaks up a microprocessor into understandable functions. Each tape seems to amplify on the previous ones. By the time the viewer reaches number three, he easily grasps concepts such as DMA, I/O lines, clock lines and other essential concepts.

Next comes "Mass Storage Devices," followed by "Character I/O." This completes most of the background of basic concepts in hardware and software. Those who have viewed the first five tapes would be comfortable in almost any discussion of computers, even one held among the most obscure, jargonistic group of engineers. But there is more to come.

Nothing is treated as lofty, holy or incomprehensible. The narrator keeps the same casual manner whether explaining how a cassette tape works or detailing the pin structure of a Z-80 microprocessor.

In "Making things Happen," viewers are shown how it all falls together. Mike the Mouse is explained; his computer-radio link made public. Home control is demonstrated, along with digital-to-analog converters and other peripherals. More hardware is introduced in the next tape, "Data Communications." Modems, bandwidth and baud rate are explained. Possibilities and actualities such as computer bulletin boards and electronic mail are introduced, as well as a detailed explanation of the RS-232 interface.

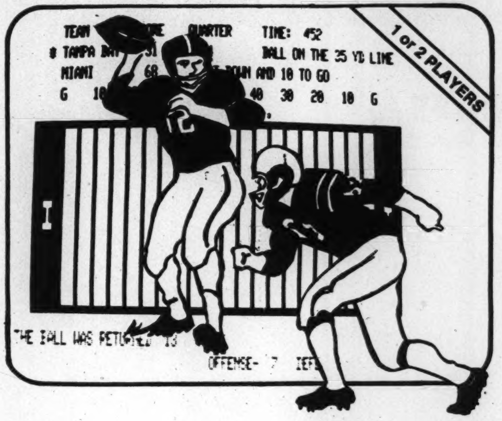
Then, as a reward for watching the first seven tapes (though they are valuable enough in themselves), comes "Speech, Music and Graphics." The capabilities of several personal computers are demonstrated in sound and video. Raster and vector graphics are explained, along with bit pads, light pens, speech recognition and speech synthesis.

The entire production is well done without being too slick. The camera work is simple, alternating between full-length shots of the host and close-ups of illustrations. The interplay of humor between the host and EV gets a bit sophomoric at times, but never unbearable or labored. The tapes last from sixteen to twenty-three minutes — perfect for classroom viewing followed by discussion — and can, of course, be rewound at any point if another repetition of a portion is desired.

A major value of these tapes is that they don't talk down to the viewer. The presentation is clear and orderly, the level suitable for anywhere from bright junior-high to adult. If you want to learn the basics of computers, this is a good way to get started. The tapes are available on a variety of plans, including rental for $35 per tape per month (minimum two tapes).

PIGSKIN

by John Laurence, Rick Sothen, Walter Gavenda



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Acorn produces several games for the TRS-80.* These include *Pinball,* a graphic arcade-like game; *Invaders from Space,* a fast action program with sound; *Quad,* a three-dimensional strategy game; and *Gammon Challenger,* the popular backgammon program. Each is available at only $14.95 on tape and $20.95 on disk for a 16k, Level II TRS-80.* Ask for these and other quality Acorn programs at your local computer store.

*TRS-80 is a trademark of Tandy Corp.

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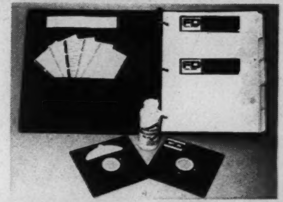

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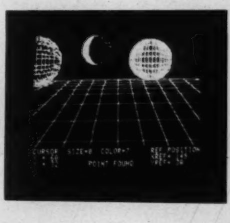

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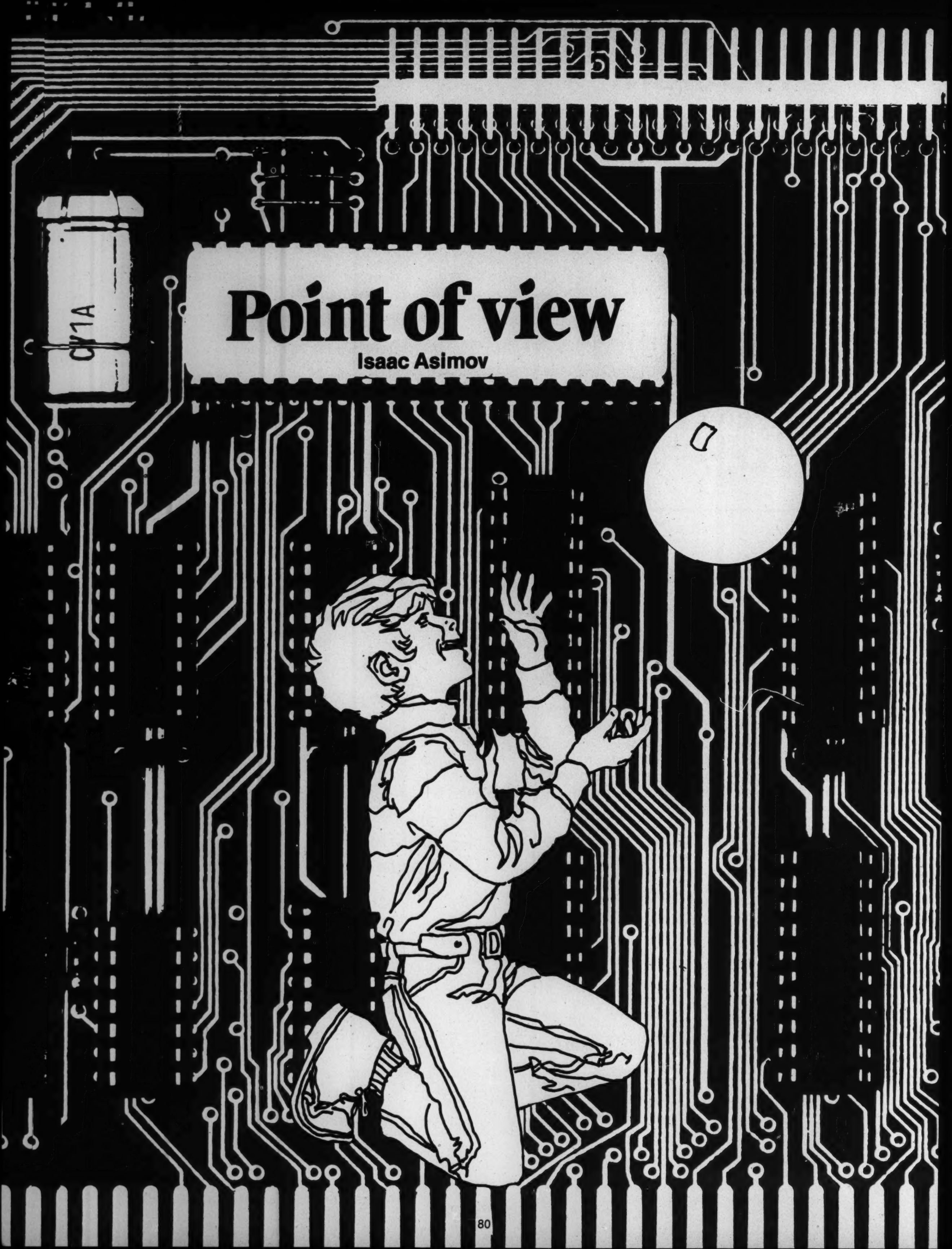
Point of view

Isaac Asimov



Roger came looking for his father, partly because it was Sunday, and by rights his father shouldn't have been at work, and Roger wanted to be sure that everything was all right.

Roger's father wasn't hard to find, because all the people who worked with Multivac, the giant computer, lived with their families right on the grounds. They made up a little city by themselves, a city of people who solved all the world's problems.

The Sunday receptionist knew Roger. "If you're after your father," she said, "he's down Corridor L, but he may be too busy to see you."

Roger tried anyway, poking his head past one of the doors where he heard the noise of men and women.

He saw his father at once. He didn't look happy and Roger decided that everything *wasn't* all right.

"Well, Roger," said his father. "I'm busy, I'm afraid."

His father's boss was there, too, and he said, "Come on, Atkins, take a break. Take the kid for a bite at the commissary."

Roger's father didn't look as if he wanted to. He had an instrument in his hand that Roger knew was a current-pattern analyzer, though he didn't know how it worked. Roger could hear Multivac chuckling and whirring all about.

But then Roger's father put down the analyzer. "OK. Come on, Roger. I'll race you for a hamburger."

When they were in the commissary with big hamburgers in front of them and French fries and shakes, Roger said, "Is Multivac out of order still, Dad?"

His father said gloomily, "We're not getting anywhere, I'll tell you that."

"It seemed to be working. I mean, I could hear it."

"Oh, sure—but it doesn't always give the right answers."

Roger was 13 and he'd been taking computer-programming since the fourth grade. He hated it sometimes and wished he lived back in the 20th century, when kids didn't take it—but it was helpful sometimes in talking to his father.

Roger said, "How can you tell it doesn't always give the right answers, if only Multivac knows the answers?"

His father said, "Son, Multivac has a brain as large as a big factory. It even has something no other computer has—the ability to grow more useful as it works. In a sense it grows with experience, but it still doesn't have a brain as complicated as the one we have here," and he tapped his head. "Sometimes Multivac gives us an answer we couldn't calculate for ourselves in a thousand years, but just the same something clicks in our brains and we say, *Whoa! Something's wrong here!* Then we ask Multivac again and we get a *different* answer—so one of them is wrong.

How do you reason with a giant computer when it begins to answer in double-talk?

"And the thing is, son, how do we know we always catch Multivac? How do we know that some of the wrong answers don't get past us? We may rely on some answer and do something that will turn out to be disastrous five years from now. Something's wrong inside Multivac and we can't find out what. And whatever is wrong is getting worse."

"Why should it be getting worse?" asked Roger.

His father had finished his hamburger and was eating the French fries one by one. "My feeling is, son," he said, "that we've made Multivac the wrong smartness."

"Huh?"

"You see, Roger, if Multivac were as smart as a man, we could talk to it and find out what was wrong. If it were as dumb as a machine, it would go wrong in simple ways that we could catch easily. The trouble is, it's *half*-smart. It's smart enough to go wrong in very complicated ways, but not smart enough to help us find out what's wrong."

He looked very gloomy. "But what can we do? We don't know how to make it smarter—not yet. And we don't dare make it dumber, either, because the world's problems have become so serious and the questions we ask are so complicated that it takes all Multivac's smartness to answer them."

"If you shut down Multivac——"

"We can't do that, son," said his father. "I'm afraid Multivac must be in operation every minute of the day and night. We've got a big backlog of problems."

"But if Multivac continues to make mistakes, Dad, won't it *have* to be shut down?"

"Well," Roger's father ruffled Roger's hair, "we'll find out what's wrong, old sport, don't worry." But his eyes looked worried just the same. "Come on, let's get out of here."

"But, Dad," said Roger, "listen. If Multivac is half-smart and growing, why does that mean it's also dumb?"

"If you knew the way we have to give it directions, son, you wouldn't ask."

"Just the same, Dad, maybe it's not the way to look at it. I'm not as smart as you; I don't know as much; but I'm not dumb either. Maybe Multivac isn't like a half-smart adult—maybe it's like a growing kid."

Roger's father laughed. "That's an interesting point of view, but what difference does it make?"

"It could make a lot of difference," said Roger. "You're not a half-smart adult so you don't see how a half-smart mind would work; but I'm a kid, and maybe I would know how a kid's mind would work."

"Oh? And how would a kid's mind work?"

"Well, you say you've got to keep Multivac busy day and night. A machine can do that. But if you gave a growing kid homework and told him to keep at it for hours and hours, he'd get pretty tired and begin to make mistakes, maybe even on purpose. So why not let Multivac take an hour or two off every day with no problem-solving—just letting it chuckle and whir by itself any way it wants to?"

Roger's father looked as if he were thinking very hard. He took out his pocket computer and tried some combinations on it. He tried some more combinations. Then he said, "You know, Roger, if I take what you said and turn it into Platt integrals, it makes a kind of sense. And 22 hours we can be sure of is better than 24 that might be all wrong."

He nodded his head, but then he looked up from his pocket computer and suddenly asked, as though *Roger* were the expert—"Roger, are you sure?"

Roger *was* sure. He said, "Dad, a kid's got to *play*, too." ❖

A New Look at the Creative Process

Part II

Eugene Raudsepp

How to Handle Ideas

The occurrence of creative ideas is often notoriously evanescent and elusive. At the moment when the idea appears, the individual may feel that it would be impossible to forget it. Yet, only moments later, the impression may become blurred or fade away altogether. If the creative individual fails to capture ideas when they occur, fails to fix them in some form for later reference, they vanish and seldom return.

It is at night when many creative individuals begin to anticipate, as one creative person so aptly put it, "a blind date with their deeper selves."

On the other hand, there are creative individuals who prefer not to make a notation of their ideas until they have matured or become more fully structured. To be sure, glimmerings of these ideas might have occurred to them before a number of times, and they might have toyed with them repeatedly, but they have done this in their heads without committing them to day. The reason for this is that some ideas take time to mature, and each subsequent emergence of them in consciousness finds them more firmly developed and structured.

With novice creative individuals, however, it is probably imperative that they fix the unexpected ideas in some form as soon as they come. As we all have experienced time and time again, some ideas appear to us brimming with important meaning at the time of their intrusion into consciousness, yet a later recall of them often fails. It is therefore imperative that such ideas be committed to paper as soon as they come.

An accomplished creative individual learns from long practice and frequent disappointments the proper technique for handling ideas. He learns, for example, that some ideas should be jotted down immediately, as soon as they occur, while others should be kept fluid and outside conscious focus until the last possible instant, and that others, again, should be dropped back into the unconscious for further development and incubation. As a general rule, the more complicated and complex the idea, the more advisable it is to postpone a too-early declarative premiere of the main lines of it. For otherwise there might be danger of committing the original implicit idea irretrievably to a restrictive scheme, the limitations of which strait-jacket the subsequent development of the idea. On the other hand, it frequently happens that the germinal force of an idea can be completely drained into a notation, and that further additions of unnecessary details to it by unconscious gestation would only mar it.

In the final analysis, the dilemma inherent in the method with which to capture and develop ideas has to be solved by each individual alone. Some individuals find that they miss the opportunity to exploit the idea by deferring notation of it, by failing to make definite commitment; others again feel that they drain their ideas dry of real novelty by imposing precision on their insights as soon as they occur. There is indeed so much variation in the methods with which creative individuals handle their ideas that it remains for each individual to discover the way between the extremes indicated to insure optimum utilization.

That our legs are the wheels of thought has been known to creative workers throughout the ages.

There seems to be a prevalent notion among many investigators of creativity that the first ideas that occur to individuals, when they are faced with finding a solution to a problem, are totally valueless. While this may be true in case of relatively unfamiliar problems, or problems on which no conscious effort had previously been spent, with problems that have been through a period of unconscious cerebration the first ideas are frequently the best. Consequently it is advisable to pay closer attention to the first ideas that occur

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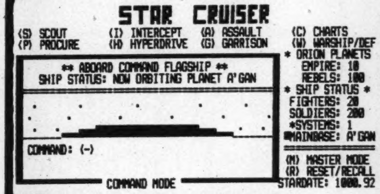

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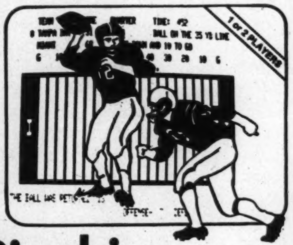

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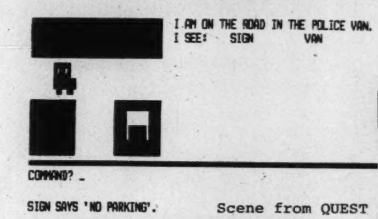

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New Look, cont'd...

during a productive mood, even though the effortless fashion in which they often appear may make them suspect.

The Primacy of the Whole

The creative process begins with the *intuitive moment.* During the intuitive moment the creative individual gets his first global feeling toward the idea he is about to develop, or which might solve his problem. It is at this moment that he has his first preverbal intimations of the implicit idea and also the direction toward a potential resolution of the idea or the solution of his problem. The intimation of the whole or the global grasp of the idea operates, during the creative process, through the channel of feeling or intuition. This intuition directs the shaping and structuring of the details during the idea's progressive articulation.

Most of the useless and valueless combinations seldom emerge into consciousness or become amenable to analytic recognition.

This intimation of the whole has to persevere through every phase of the progressive molding of the idea, until the creative individual finally feels that he can place a stamp of approval upon the new product. A savoring consummation, a sense of completion, accompanies this action, which in turn signifies that the more-or-less full exploitation of the original idea has occurred.

The intuitive global idea furnishes both the end and the means for achieving this end. It guides the elaborate forming of the idea safely through the shifting chaos of an enormous number of either unconsciously or consciously perceived alternatives and details to its unique terminus. It may occasionally happen that elements and details that are first incorporated into a new creative idea drop out later, or are seen to be irrelevant, and that others may take their place. But this phenomenon does not argue against the theory that it is the implicit whole that determines what is to be admitted and what is not to be admitted into the evolving idea. Only when the individual has a firm grasp of the intimated whole is he able to burrow down to the appropriate data in his memory and to assemble the elements that contribute toward the development of the idea. Only then is he able to introduce proper elaborations; to selectively choose past observations; to restructure, combine and transform the details that go into the development of the idea. The test with all of these facets of creative labor is the immediate feeling that the details either belong or do not belong, either contribute or do not contribute to the emerging configuration. This intuitive feeling continues until the moment when the individual finds that he cannot add or change anything about his product to improve it.

The emerging total idea or product is, as a rule, blessed with a series of fragmentary and relatively minor insights before the total import of the idea is brought home to the creator. When this occurs, he may have already covered the better part of his task, and may have been correctly oriented, so that the import of the more inclusive insight into the original concept does not effect any major revision or reorganization in the already completed portions of the idea. With many other projects, of course, the wastepaper basket and the littered floor may give silent testimony to the numerous arbitrary beginnings, to loose and fumbling directions, to mounting restlessness and impatience, before a satisfactory starting point is trapped.

One chief reason why the creative process almost invariably produces a severe strain is because the intimation of the implicit idea and its developmental direction must be maintained at all costs: in the teeth of many unwelcome distractions, whether external or internal; throughout the fleeting and unexplained momentary inhibitions, irrelevant impulses, sudden fatigue or flagging interest; through moments of self-consciousness and doubts about the idea's real value, the suddenly remembered obligations and concerns and many other factors that are the lot of the creative individual in his environment.

A quite opposite pattern of the process just outlined occurs when the creative individual feels that he can give in to the white heat of his productive mood. He then attends to his work unhampered by the strain of having to sift an excess of consciously perceived alternatives at each successive step in the idea's development. He does whatever his unconscious promptings lead him to do, and ultimately finds that his idea has grown effortlessly and spontaneously. It is obvious that ideas developed in this fashion need, as a rule, very little revision. All in all, however, this mode of creating, although coveted by most creative individuals, is either a relatively rare occurrence, or it cannot be maintained too long for any period of time.

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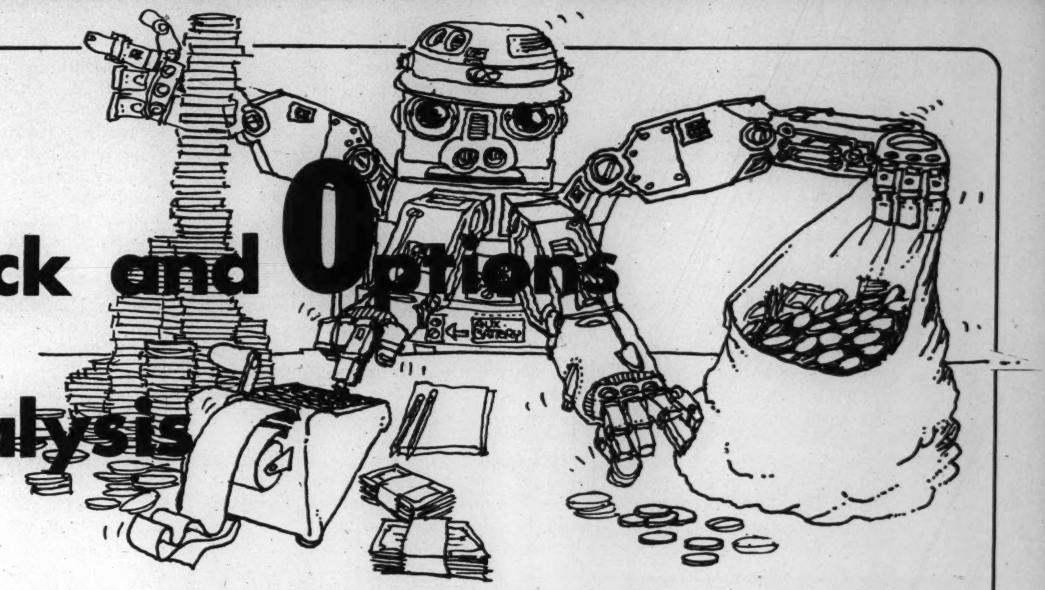
"You are specialist for tele-processing?"

Constraint, mounting effort and tension inevitably set in sooner or later. As tension mounts beyond an optimim point, the creative individual feels that he is forced to spend more and more effort on less and less results. He finds that errors start to pile up and that his direction becomes rambling and confused. This is the time when most creative people quit. Others, the more obstinate ones, stick by their work and either take recourse to their richly stocked bag of methods of the past, or continue consciously to elaborate as much as possible in the remembered key of the initial conception. The later numerous rough drafts bear witness to the fact, however, that it is almost impossible for the creative individual consciously to assume conformity with the intimated end of his new idea when the hum of the mood has stopped and when he finds himself no longer tuned in to the unconscious. The firmer his anticipation of the initial totality is, the easier. Other things being equal, it is for him to shape its emerging derivatives, fight adventitious conscious choice, and arrive at a satisfactory creative product.

The condition of inward isolation that takes the creative person out of the context of his activity and obligations is the primary requirement for significant creative work.

Many scientists have noted that the intuitive moment indicates the arrival of a possible solution. Albert Einstein, for example, is said to have had the capacity to feel the direction of a possible solution for his problem before he actually knew what the solution was. The psychologist Max Wertheimer, who made a close study of Einstein's thought-process, reports: "I once told Einstein of my impression that 'direction' is an important factor in thought process. To this he said, 'Such things were very strongly present. During all those years there was a feeling of direction, of going straight toward something concrete. It is, of course, very hard to express that feeling in words; but it was decidedly the case, and clearly to be distinguished from later considerations about the rational form of the solution. Of course, behind such a direction there is always something logical; but I have it in a kind of survey, in a way visually." Wertheimer concluded that "scrutiny of Einstein's thought always showed that when a step was taken this happened because it was required." "Quite generally,"

Stock and Options Analysis



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New Look, cont'd...

he adds, “if one knows how Einstein thinks, one knows that any blind and fortuitous procedure is foreign to his mind.” A. Reiser, in his book *Albert Einstein*, comes to a similar conclusion. “Once he has come upon a problem,” Reiser writes, “his path toward solution is not a matter of slow, painful stages, He has a definite vision of the possible solution, and considers its value and the methods of approaching it.” Einstein intuitively sensed what the solution to his problem would be, and he always trusted and acted upon his hunches.

When we scrutinize closely the creative process in engineering, it becomes obvious that all the preliminary chaotic collection and gathering of data and facts and the feverish accumulation of materials are only seemingly chaotic and unsystematic. Any engineer starting research on a particular problem is already under the sway of an intuitive hunch that imputes relevance to the facts he so assiduously collects. No engineer ever has a hunch, nor can he pose a problem, if he is wholly in the dark about a possible solution and what data he needs to arrive at a solution. If he does not arrive at a satisfactory solution, the trouble may lie in the frightful complexity of the problem, but it seldom lies in the genuine original hunch.

The ideas they have valued most occur to them during passive, relaxed or even fatigued states of half-waking conditions.

Selectivity in the Creative Process

The best evidence that there is an intimation of an implicit whole at the intuitive moment is the highly selective activity that occurs throughout the creative process. Selectivity works through the intuitive feeling of moment-to-moment appropriateness and suitability of the details and elements being incorporated into the evolving idea, guiding the choice of the details and elements that are to be used and the way they are to be used.

Selectivity is operative in the total spectrum of the creative endeavor, starting with the choice of the problem to be worked on. In addition to the compelling preference exhibited toward a problem, there is the selection of specific experiments to be run to form the groundwork for solving the problem or developing the idea. In the process of developing the idea itself, selectivity is operative in that elements and details that belong are admitted and those not felt to be contributory are suppressed. Thus selectivity cuts across all the facets of the creative process.

The structure that the implicitly intimated whole of the novel product demands is, in the beginning stages, only vaguely felt. Many of the details, their balances and correspondences, although tending toward the implicit whole, are not quite consistent or congruent with the sensed whole, and require much restructuring before they jibe with the requirements of the implicit configuration. But so pervasive and insistent is the established sense of the whole, the unifying pull of its nature, that it imposes the conditions for its realization and inexorably demands the proper transformations, re-arrangements and regroupings. As John Ferren has expressed this: “Structure demands a certain quantity and a certain quality of all the elements and insists on it, and it leads you to it or breaks your neck doing it.” Ross L. Mooney has remarked on the presence of feeling-selectivity in the realm of technical research this way: “The process is held together by feeling. The research man trusts his feeling for telling what belongs and does not belong, what is appropriate, what fits, what is to be taken together. . . . It is the feeling of one's way through, and it will tie in to a thing called appropriateness, to fit, to grouping, to clustering.”

The feeling or sensing aspect, the affective base in creative activity, cannot be overemphasized, for it constitutes the only measure or yardstick by which the highly selective process during the creative forming works cumulatively toward that essential unifying quality without which there can be no keeping of the elements in their proper places. The creative individual must sense the appropriateness or inappropriateness of every single element that he adds to the developing idea and measure his molding of it by the implicit yardstick of the intuited whole of the idea. He has to constantly maintain a pervading intuitive sense for the proper balancing of elements and details in order to insure their rightful place in the orchestration of the whole.

The selectivity inherent in the creative process allows the creative individual to find his way through an enormous number of possibilities and suggestions that sometimes emerge; it makes him ever ready to grasp the essentials in chance combinations and it helps him to find materials relevant to his central idea among the most disparate and dissimilar elements in the total realm of his experiences. It acts like a magnet that draws from memory the proper facts, data and impressions, and urges their expression in a form that is, for that particular idea, most fitting in terms of the sensed appropriateness.

The elimination of inessential or useless ideas during the creative process occurs mainly unconsciously under the influence of the original conception. It is implicit, since most of the useless and valueless combinations seldom emerge into consciousness or become amenable to analytic recognition. If some of them emerge into consciousness, they may influence the creative activity by blocking temporarily the emergence of the right elements. That the elimination of inessential elements occurs mainly unconsciously, as first indicated by the famous French mathematician Henri Poincaré. “It is certain that the combinations which present themselves to the mind in a kind of sudden illumination after a somewhat prolonged period of unconscious work are generally useful and fruitful combinations, which appear to be the result of a preliminary sifting. But how can we explain the fact that, of the thousand products of our unconscious activity, some are invited to cross the threshold, while others remain outside? Is it mere chance that gives them this privilege? Evidently not.” Poincaré then continues in a more explicit vein by stating that “the sterile combinations do not even present themselves to the mind of the inventor. Never in the field of his consciousness do combinations appear that are not really useful, except some that he rejects but which have to some extent the characteristics of useful combinations.”

Many seasoned creators have an unreasoned, intuitive sense for the preparatory cues, the external conditions that are necessary for the evocation of a creative mood.

Poincaré also recognized what most great creative individuals have noticed, namely, that their unconscious has a discerning, discriminating power that can effect correct choices even where the conscious or rational reasoning on a problem has given up the battle as lost.

There is not only evident the crowding out of many elements and details that have no relationship with the idea, but also the establishment of what can be called a permissive condition for combinations and syntheses to occur. It often happens that after the new idea has become more explicit, it assumes the characteristics of the *idée fixe* (fixed idea or obsession). This enables the creator to gather impressions, data, facts and information in support of the development of the idea in the most unlikely realms of knowledge and experience. Many phenomena originally seen to have no kinship with what the creative individual is preoccupied at the time now fall under the beam of the *idée fixe* and are interpreted in the light of it. His perceptions become selectively attuned to notice and register things that seem to add, verify or confirm his idea. There is also present an increased power to organize and combine these contributory impressions so that

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New Look, cont'd...

they will fit into the central theme of the new idea.

Optimum Conditions for Creative Thinking

The spontaneous appearance of new ideas cannot easily be foretold, except by a feeling of peculiar restlessness just before the advent of one, and it is quite impossible to induce ideas at will. Creative ideas are not under our voluntary control, and as a consequence cannot be governed by planning, schedules or sheer enforcement. Goethe, for example, attributed his sixty years of toil with *Faust* to the detrimental and barren efforts of will. Will reigns over the already established order of consciousness, it does not have the power to induce a flood of the novel, less determined or less defined materials from the unconscious. Hence the sterile periods and dark days known to all creative individuals.

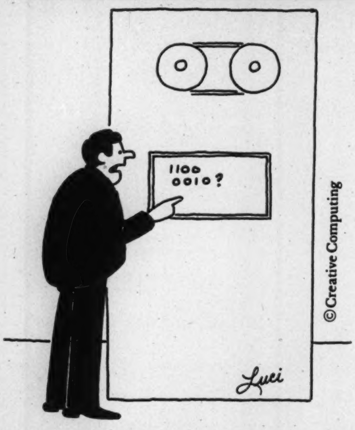
The spontaneous appearance of new ideas cannot easily be foretold, except by a feeling of peculiar restlessness just before the advent of one, and it is quite impossible to induce ideas at will.

But once the creative current runs strong and the organic devlopment of the idea is underway, one can asume an attitude which resembles will and which helps to maintain the creative heat at a certain desirable intensity. This attitude is a wish, a challenging urge of the creative individual to give his utmost while submitting to the workings of the creative act. Any genuine creative engineer wants to transcend his past performance, to give at every new occasion of problem solving his best, and thus achieve more than he has aspired to achieve before. This urgent wish toward a fuller and richer self-realization helps the creative individual to sustain the intensity of the creative mood and keep the avenues with the unconscious free from both internal and external interruptions as well as from the established habit-patterns of consciousness.

While it is impossible to induce creative ideas at will, there are nevertheless certain conditions which are propitious for the evocation of ideas, conditions that stimulate the potent unconscious matrix from which novel ideas well forth. For example, the time of day that is conducive for the evocation of creative mood and the creatively detached condition is for innumerable individuals the night, when the world sleeps and the wearisome hustle of the day has exhausted itself. It is at night when many creative individuals begin to anticipate, as one creative person so aptly put it, "a blind date with their deeper selves." The daytime, with its predominantly instrumental and practical orientation, its bustling activity, blinding glare, and incessant noise, can act as a blockage to creative ideas and prevent their flow from the unconscious. The night, on the other hand, with its all-pervading, living peace and the inscrutable mystery of darkness, brings to many creative individuals a spiritual rapport and identification with nature or a sense of cosmic isolation that is conducive to the arousal of creative mood.

There are other individuals, of course, who prefer the early morning hours, the freshness of a new-born day for their creative labors. Others again need a high-powered activity around them in order to find spontaneous release for their ideas. They have to escape into the whirlwind of organizational hustle and depend on the restless activity of the environment to give them the necessary stimulus for the emergence of productive ideas. But even in their case the knack of closing out the external world at will, of being able to detach themselves instantaneously and whenever necessary from whatever they had depended upon as a stimulus to set the ideas in motion, is an essential ability in their repertoire.

It must be emphasized that the ability to become inwardly isolated at will is not necessarily conditional on the outward isolation, and many creative engineers can tune in on their private selves in the noisiest of environments. The condition of inward isolation that takes the creative person out of the context of his immediate instrumental or environmental activity and obligations is, however, the primary requirement for significant creative work. Without such detachment he cannot exploit fully his creative ideas. In fact, moments of that kind of detachment from the encumbrances of environment can be more productive than hours of merely physical isolation.



"Because you're a computer, that's why you can't go fishing with me!"

Many of the idiosyncrasies and peculiarities of creative individuals that delight the biographers, providing an endless source of anecdotal material, have been their peculiar ways of evoking the creative mood.

Debussy, for example, used to gaze at the river Seine,and the playful golden reflections of the setting sun on its waves, to establish an atmosphere for composing. Schiller kept rotten apples in his desk-drawer. Their aroma helped him to evoke a mood for creative work. Dostoevsky found that he could best brood and dream up his immortal stories and characters while pen-drawing and doodling. It seems that there is hardly a creative individual who does not have a special habit, eccentricity or ritual in order to be able to have that free-floating concentration, that alertness to all the implications and developments of a novel idea and the uncensored images that emerge. These habits seem also necessary for the keeping of the overactive thought-patterns of consciousness in abeyance, and for the shutting out of all other distractions. By the anchoring of oneself to only one single distraction, such as smoking or biting the end of the pencil or scratching one's forehead, outward distractions are muted or recede into nothingness. This is essential, for a shrill ringing of the telephone in the next room, a conversation down the hall, a rumbling stomach or some other momentary bodily discomfiture could act like a pin-prick to shatter the protective bubble of creative mood. By channeling the distraction into one ritual or habit, all the other distractions lose their disrupting power.

Some ideas should be jotted down immediately, as soon as they occur, while others should be kept fluid and outside conscious focus until the last possible instant.

Many creative individuals pace the floor endlessly and the accounts of past masters are replete with instances of creative ideas occurring to them when they were walking or hiking or traveling. That physical motion animates and augments the flow of imagination and ideas, and that our legs are the *wheels of thought* has been known to creative workers throughout the ages.

The problem of when creative individuals prefer to work and what habits they have developed to concentrate most effectively cannot be understood in terms of any cause-and-effect relationships. So

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Registration fee is only $10 per day, and all registrants have free access to the hourly lectures.

LECTURE PROGRAM

A schedule of free lectures is available to all visitors. Lectures run about 50 minutes each, including, in most cases, some time for questions from the floor. Some topics are given twice, and, in some cases, topics of related interest are given on the same day for the visitor's convenience. (Program is subject to change without notice, but lectures will be posted daily in the show lobby.)

THURSDAY, OCTOBER 30

Noon Introduction to Small Systems for Business, Stan Veit, Associated Computer Industries

Noon Mailing Lists: Several Directions, Dr. Norman I. Agin, Mathtech, Inc.

1 p.m. Selecting a Small Computer for Business, David Benevy, Computer Mart of New Jersey

1 p.m. Evaluating and Improving Your Computer's Performance, Philip Grossman, Raytheon Co.

2 p.m. Law Office Systems Aspects of Word Processing, Bernard Sternin

2 p.m. Future Smart Machines: 2000 A.D. and Beyond, Dr. Earl Joseph, Sperry Univac

3 p.m. Computer Contracts—Facing the issues, Alan C. Verbit, Verbit and Company

3 p.m. Accounts Receivable/Accounts Payable/General Ledger

4 p.m. Using FORTRAN on a Microcomputer, Richard A. Zeitlin

4 p.m. Investment Analysis of Stocks and Commodities on a Microcomputer, Fred Cohen, Shearson Loeb Rhoades, Inc.

FRIDAY, OCTOBER 31

Noon Introduction to Small Systems for Business, Stan Veit, Associated Computer Industries

Noon BASIC Programming, Michael Mulcahey, Worcester Stage College

1 p.m. Selecting a Small Computer for Business, David Benevy, Computer Mart of New Jersey

1 p.m. Videoprints: Full-Color, Low-Cost, Hard-Copy Computer Graphics, Warren Sullivan, Image Resource Corp.

2 p.m. Mailing Lists: Several Directions, Dr. Norman I. Agin, Mathtech, Inc.

2 p.m. Business Applications Software Development via Data Base Management, Dr. Andrew Whinston, Micro Data Base Systems

3 p.m. Application of PASCAL to Small Systems for Business, Panel, Stan Veit, Moderator, Associated Computer Systems

3 p.m. Investment Analysis of Stocks and Commodities on a Microcomputer, Fred Cohen, Shearson Loeb Rhoades, Inc.

4 p.m. Advantages of Distributed Processing and Multi-Processing, John Steefel, Q1 Corp.

4 p.m. To be assigned.

SATURDAY, NOVEMBER 1

Noon Educational Software: The Good, the Bad, the Ugly. Jo Ann Comito, S.U.N.Y. at Stony Brook

Noon Introduction to Personal Computing, RCA—Solid State

1 p.m. Computer-Assisted Mathematics Courses, Dr. Frank Scalzo, Queensborough Community College

2 p.m. Artificial Intelligence Update, Prof. Peter Kugel, Boston College

2 p.m. Compiling and Retrieving Personal Medical Data, Dr. Derek Enlander, St. Luke's Hospital

2 p.m. The Present State of CP/M Compatible Software, Tony Gold, Lifeboat Associates

3 p.m. High Volume Data Handling: An Introduction to File Processing, Prof. Peter Kugel, Boston College

3 p.m. Connecting the Computer to the Outside World, Prof. James Gips, Boston College

4 p.m. Educational Applications in the Home, David Ahl, "Creative Computing Magazine"

4 p.m. Household Applications—Some New, Dr. Dennis J. McGuire

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An executive education session will be given daily for four days, Oct. 29 through Nov. 1, in the New York Coliseum. Each session is limited in attendance, and reservation must be made. Registration is on a first-come, first-served basis. Fee is $200, and includes three-day admission to the National Small Computer Show, coffee break, and workbook materials. Please write or call the show office for session outline and registration form. (Do not use registration form in this ad for special session.

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12 ☐ Engineer (All)
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New Look, cont'd...

much variation exists in the habits and the preferred time for working that it can be safely concluded that the only optimum times and conditions for the production of novel ideas are the occasions when the creative individual attains an uncluttered rapport with his unconscious and feels free from the practical demands of the environment. The other condition is that he should be also free from the stereotypical orientation of his own noncreative periods of working and living and the conservative, established ways of thinking that crowd his consciousness during those periods. This also accounts for the frequent claim of the majority of creative workers that the ideas they have valued most occur to them during passive, relaxed or even fatigued states of half-waking conditions. John Dewey says in this regard: "I do not think it can be denied that an element of reverie, of approach to a state of dream, enters into the creation of a work of art, nor that the experience of the work when it is intense often throws one into a similar state. Indeed, it is safe to say that creative conceptions in philosophy and science come only to persons who are relaxed to the point of reverie. The subconscious fund of meanings stored in our attitudes have no chance of release when we are practically or intellectually strained."

Only when the individual has a firm grasp of the intimated whole is he able to burrow down to the appropriate data in his memory and to assemble the elements that contribute toward the development of the idea.

Inventors also have been aware of the advantages of relaxed moments. It is well known that Newton solved many of his problems when his attention was waylaid by complete relaxation. Similarly Edison knew the value of half-waking states, and, whenever confronted with a seemingly insurmountable hitch that defied all his efforts, he would stretch out on his couch in his workshop — brought there for just this reason — and try to fall asleep.

Creative mood may seize the individual without any detectable reason or stimulus; it can be catalyzed apparently by many insignificant and wayward incidents. Since one of the salient characteristics about intuitive moments is that they are not under voluntary control, that often they occur without warning, creative ideas may and do appear at any hour and under the strangest of circumstances. For example, there is a story about Vivaldi being overcome by inspiration while celebrating Mass. As soon as the "divine afflatus" had struck him, he rushed away from the altar into the sacristy, where he noted down his theme. It was only after he had carefully marked down the melody and assured himself of its retention that he returned to the altar to resume the Mass. Needless to say, the officials of the church, ignorant of the wayward surprises of the creative process, summarily dismissed him from his office.

Another incident has been reported about Newton, who, during the course of a dinner he was giving to his guests, left the table to get some wine from the cellar. On his way from the cellar he was overcome by an idea, forgot his errand and company, and was soon hard at work in his study.

Many seasoned creative engineers have an unreasoned, intuitive sense for the *preparatory* cues, the external conditions that are necessary for the evocation of a creative mood. Although it is impossible to summon creative ideas at will, many creative individuals have mastered the trick of exposing themselves to stimuli which make the occurrence of creative mood possible. Experience will eventually teach every creative man which environmental conditions are propitious for creative concentration. There are many stimuli that act as catalytic agents and induce the mood. We all know that an interesting lecture, a visit with a colleague, an overheard perceptive remark, a hike in the freedom of nature — as a matter of fact, any stimulating event that upsets "the needle in the groove" — may put us in a proper mood for creative work. For the painter, the smell of paints or turpentine; for the composer, the sound of distant music; for the writer, a stimulating exchange of ideas; for the scientist or engineer, the sight of his laboratory equipment, may serve as preparatory cues for creative activity. These are cues that are more-or-less directly associated with a particular creative individual's work, but not with the specific problem that is later solved or with the idea that is later developed.

As appreciators and spectators of art, even laymen have learned to react to preparatory cues. Thus the sound of musicians tuning their instruments before a performance of an opera or a concert serves to put the audience into a receptive state of mind; in museums and art galleries the hushed silence, appreciative cocking of heads and pensive rigidities of posture may be sufficient to engender the same kind of attitude; a detachment, however transitory, from personal cares and preoccupations.

There are, on the other hand, long stretches of barren periods in every creative individual's life. It might be safe to estimate that, for every creative worker periodically successful in solving his problems, there are several who go through varying degrees of barren sterility, and who only manage occasionally to glimpse the tail end of the evanescent mood. To some, perhaps less integrated individuals, there are periods when the incipient mood for productive activity serves to arouse all kinds of conflicts instead of healing ideas, with the result that they lapse and remain in a state of indolence, lassitude and apathy, and find numerous excuses to postpone creative work, sometimes for months or years. Others again desperately pine for the return of productive mood, but are unable to rouse the power from its slumbers. To be sure, there may be relatively long periods in every creative individual's life when for one reason or other the creative fountain has run dry, when he can only imitate and copy his old achievements. But he usually manages to survive these periods of sterility and continue to grow with the renascence of his productive powers. Luckily, as the writer Colin Wilson has suggested, "creative energy tends to be self-renewing, and to produce its own chain reaction of health and further effort."

So pervasive and insistent is the established sense of the whole, the unifying pull of its nature, that it imposes the conditions for its realization and inexorably demands the proper transformations, re-arrangements and regroupings.

There are also, of course, a large number of creative individuals who work daily, irrespective of the presence of a driving inspiration, and who show an amazing amount of patience and fortitude in mastering their disinclinations to work. While the amount and quality of their legacy to the creative arsenal of the world may not in any way exceed the legacy of those creative individuals who evidence no such routine in their output, at least they are spared the pain of humiliation of barrenness.

The creative engineer, although depending on productive mood and an organizational climate that stimulates problem-solving behavior, gains if he establishes regular habits of work. He should regulate and coordinate preparation or intake of fresh information, experience, impressions; he should give time for the digestion or incubation process; he should note how long it takes for novel insights to emerge and how long it takes to elaborate them into viability. He is likely to show greatest efficiency and creative output when he adheres to his individual rhythm inherent in these phases. Frequent violation of any of these phases by undue haste or tardiness can retard his creative efficiency. ☐

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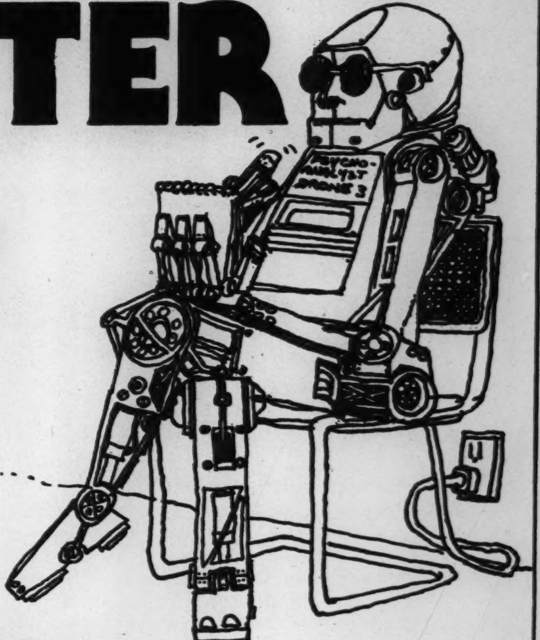

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Computer Literacy Bibliography

Code: E — Elementary Grades
J — Junior High School
H — Senior High School
R — Reference

A. Computer Applications/Societal Issues

Adams, J. Mack & Douglas H. Haden. *Social Effects of Computer Use and Misuse.* New York: John Wiley & Sons, 1976. (H+, R) Includes introductory chapter on computers, chapters on history, applications, artificial intelligence, misuses of computers, privacy, and the social, economic and philosophical implications.

Ahl, David H. Ed. *The Best of Creative Computing.* Vol. 1, Morristown, N.J.: Creative Computing Press, 1976. (R) The best on a variety of topics from *Creative Computing Magazine.*

The Best of Creative Computing, Vol. 2, Morristown, N.J.: Creative Computing Press, 1977. (R) The best on a variety of topics from *Creative Computing Magazine.*

Arbib, Michael. *Computers in the Cybernetic Society.* New York: Academic Press, 1977. (R) Contains some valuable information. Topics covered include information about computers, simulation of complex systems, data banks, artificial intelligence and networks.

Bailey, Richard. *Computer Poems.* Drummond Island, Michigan: Potagannissing Press, 1973. (R) Collection of poems either computer-generated or inspired from random computer-generated "thoughts."

Ball, Marion and Sylvia Chase. *Be a Computer Literate.* Morristown, N.J.: Creative Computing Press, 1977. (E) An introduction to computers and to writing simple programs in Basic.

Benquai, August. *Computer Crime.* Lexington, VA: D.C. Heath & Co., 1978. (R) Explores strengths and weaknesses of existing legal structure in investigating and prosecuting crimes that involve the use of computers.

Billings, Karen and David Moursund. *Are You Computer Literate?* Forest Grove, OR: Dilithium Press, P.O. Box 92, Dept. CT, 1979. (J,H) Well done book. Covers a variety of computer literacy topics and offers many activities to develop student awareness and understanding of computers.

Davis, William and Allison McCormack. *The Information Age.* Reading, Mass: Addison-Wesley, 1979. (H) Sections include an overview of the computer impact, the basic technology, uses of computers (primarily in data processing), problems and future views.

Dorf, Richard. *Computers and Man: Second Edition.* San Francisco: Boyd and Fraser Publishing Co., 1977. (H+) Beyond the usual computer-literacy topics, includes valuable information in such areas as simulation and games, computers in government systems, in the arts and artificial intelligence and cybernetics.

Graham, Neill. *The Mind Tool: Computers and Their Impact on Society. 2nd Edition.* St. Paul, Minnesota: West Publishing Co., 1980. (J,H) Excellent overview, with short and informative chapters on computer applications in many different areas, as well as introductory programming using Basic.

Holorien, Martin O. *Computers and Their Societal Impact.* New York: John Wiley & Sons., 1977. (J,H) Includes applications in education, business, government, crime and health. Has a chapter introducing Basic and a chapter on Flowcharting.

Leavitt, Ruth ed. *Artist and Computer.* Morristown, N.J.: Creative Computing Press, 1976. (R) Good discussion (with many pictures) of the computer's role in the artistic process.

McCauley, Carole Spearin. *Computers and Creativity.* New York: Praeger Pub., 1974. Focus is on the creative process and the use of computers in such areas as poetry, graphics, art, music, and dance.

Susan Friel, Assistant Professor, Mathematics; Nancy Roberts, Assistant Professor, Education, Lesley College, 29 Everett St., Cambridge, MA.

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Nelson, Ted. *Computer Lib/Dream Machines.* Swarthmore, PA: Ted Nelson, Publisher (distributed by The Distributors, 702 S. Michigan, South Bend, IN 46618). (R) Interesting and fun to read. Covers all kinds of thoughts about and uses of computers.

Parker, Donn B. *Crime By Computer.* New York: Charles Scribner's Sons, 1976. (R) Information on the variety of ways computers have been used as tools to aid in committing crimes.

Rothman, Stanley and Charles Mosmann. *Computers and Society.* Chicago: Science Research Associates, 1976. (H) Sections include what computers are, the computer influence in society, how computers are controlled, and a look at the future.

Sanders, Donald H. *Computers and Society.* New York: McGraw-Hill, 1973. (J,H) Includes sections on computers, computer influence in society, selected uses of computers, and a look at the future.

Scientific American: *Computers and Computation.* San Francisco: W. H. Freeman & Co., 1971. (R) Somewhat of a classic, containing readings in such areas as fundamentals of artificial intelligence and computer models.

Silver, Gerald. *The Social Impact of Computers.* New York: Harcourt Brace Jovanovich, 1979. (H) Very good book. Consists of four parts: the beginnings; what computers are; how computers are used; and how computers relate to people. Has good chapter introducing some of the more common privacy and credit laws in effect.

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B. Programming; Computer Science; What is a Computer?

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Dwyer, Thomas and Margot Critchfield. *Basic and the Personal Computer.* Reading, MA: Addison-Wesley, 1978. (H,R) Excellent introductory text to Basic on the personal computer, with demonstrated computer applications in several areas, including games, art, business and simulation.

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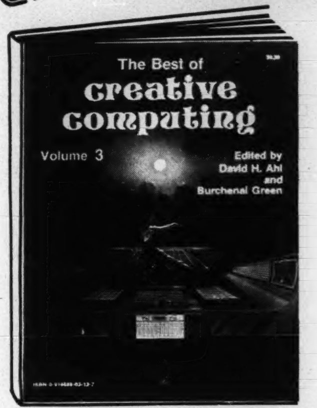

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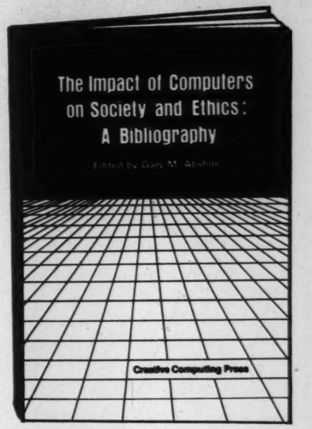

Where is the computer leading us? Is it a menace or a messiah? What are its benefits? What are the risks? What is needed to manage the computer for society's greatest good? Will we become masters or slaves of the evolving computer technology?

This bibliography was created to help answer questions like these. The works cited can provide the range of facts and opinion necessary to your understanding of the role of the computer.

This is a bibliography of works dealing with the ways in which computers are being used in our society, the beneficial changes that are taking place in our lives as a result of computer technology, the social and ethical problems intensified by the improper use of computers, the dangers of computerized society, the safeguards and defenses against those dangers, the attempts to indicate what computerized direction the future will take, and the responsibilities of computer professionals. It contains 1920 alphabetical entries of books, magazine articles, news items, scholarly papers and other works dealing with the impact of computers on society and ethics. Covers 1948 through 1979.

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C. Teaching Resources

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D. Periodicals

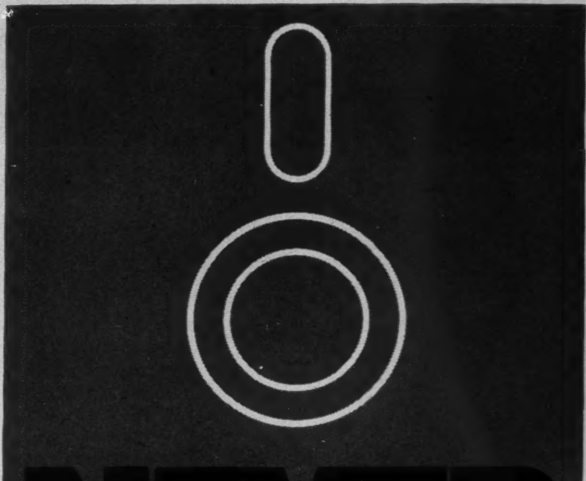
Creative Computing, P.O. Box 789-M, Morristown, N.J. 07960.

EDU, Educational Products Group, Digital Equipment Corp., ML5-2/M40, Maynard, Mass. 01754.

Recreational Computing, P.O. Box E, 1263 El Camino Real, Menlo Park, CA 94025.

The Computing Teacher, Computing Center, Eastern Oregon State College, La Grande, Oregon 97850.

T.H.E. Journal, Information Synergy, Inc., P.O. Box 992, Acton, Mass. 01720 ☐



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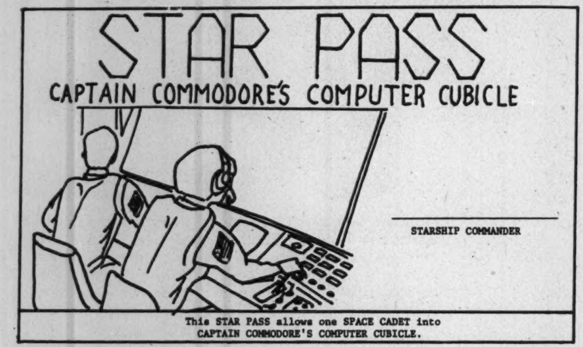
Computer Countdown

Chris Hansen

When students at Minnie P. Blair Middle School decide to use a computer, they don't just walk down the hall or go to a corner of the room; they embark on a cosmic adventure. They become space cadets who carry official Star Passes signed by the starship commander. They become space navigators, engineers, and science officers who must man the helm of Captain Commodore's Computer Cubicle.


STAR PASS
CAPTAIN COMMODORE'S COMPUTER CUBICLE
STARSHIP COMMANDER
This STAR PASS allows one SPACE CADET into CAPTAIN COMMODORE'S COMPUTER CUBICLE.

The Star Pass is signed by the principal and then laminated so it can be used over and over again.

Why all of the space jargon associated with computers? Our middle school was the first school in the county to ask for and receive small computers for classroom use. Three PET Commodore 2001 computers were brought into the school at the beginning of the school year, but they lay idle. The teachers were afraid to walk the halls at night. They heard rumors that strange PETs had been loosed and the strong possibility of attack was ever present. The majority of students saw a strange green glow coming from a seldom-used teachers' preparation area. The word "computer" was being whispered among some of the students, but no one seemed to be interested.

As with anything new in a traditional setting, computers in our middle school were an object of mistrust rather than of interest. The students were willing enough to try the PET computers, but most of the teachers wouldn't take the time to learn how to insert a cassette into them. The three computers were spread throughout the school. One was being used by one-third of the students, but the other two computers were never touched by the other two-thirds of the student body.

Something had to be done to generate student and teacher interest. The three computers were brought together and placed in the small, seldom-used teachers' preparation area. From there, the transformation from schoolroom to starship began. The unadorned room became Captain Commodore's Computer Cubicle. The name of the room is printed in six-inch multi-colored letters above and on each side of the door. Four bolts of lightning, cut from bright yellow butcher paper, strike at the entrance door from each corner of the wall, and a poster of earth as seen from space is in the center of the door. Mounted to the right side of the entrance are the small outlines of PET computers numbered one to seven. Students must take a numbered cardboard PET when they enter the cubicle. When all of the numbers are gone, other students wishing to use a computer are able to see from quite a distance that the room is full and know that they will have to come back later. Students return the numbered PETs when they leave. Other posters inside the cubicle are of planets, space walks, and docking space craft. It's as if the student is in the control room of a space craft looking out into space. The computer is the student's control panel.

In order to get the uninterested teachers involved with the computers and to get them to let their students participate, the starship commander (the principal) issued Star Passes to all teachers. These Star Passes are given to any student who wishes to use the computer and has his or her work done satisfactorily. The word soon spread among the students and they began asking for the Star Passes. Eventually even the teachers most adamantly against letting their students use the computers were issuing the Star Passes.

> **Within weeks the PETs were no longer feared as wild things.**

Within weeks the PETs were no longer feared as wild things. The computers were being used before, during, and after school. Many of the students would rather spend their lunch hours and free time in the Computer Cubicle than on the playground. So much interest was shown that a concerned parent began a student-only programming course one night a week. He eventually also taught an in-service course for teachers. Over twenty-five teachers took the course and wrote and saved programs which the students are presently using. Two of the seventh grade students and one of the sixth grade students took the computers to a school board meeting and gave a demonstration with the programs they had written.

A tremendous problem when introducing computers into a school is getting them accepted as an extra helper and getting teachers enthused about them. Once this is done, the school is on its way to some exciting experiences. And it says on the PET screen at Minnie Blair Middle School at the end of a successfully completed program:

CONGRATULATIONS. YOU ARE
NOW A MEMBER OF MY SPACE
TEAM AND WE ARE HEADED BACK
TO EARTH.
CAPTAIN COMMODORE
SIGNING OFF . . . ☐

Chris Hansen, 355 W. Stillwater Ave., Fallon, NV 89406.

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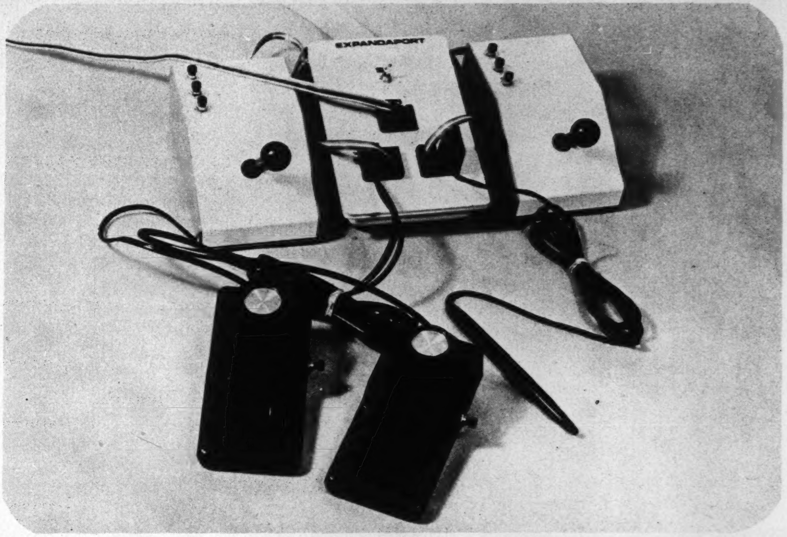

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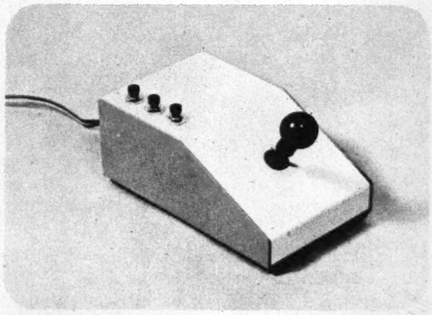

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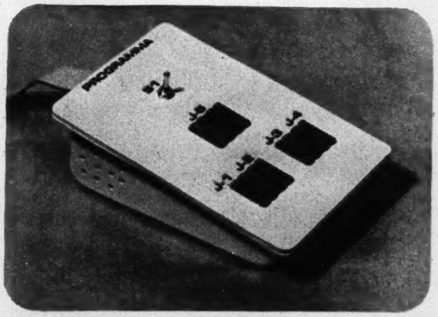

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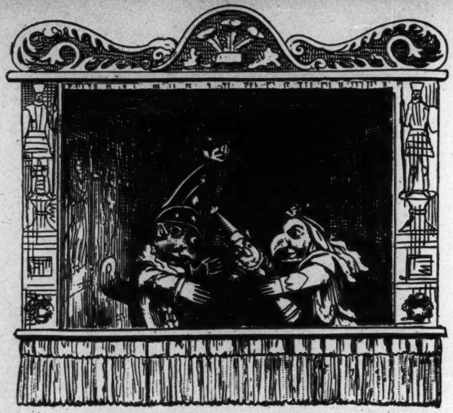

Michael Potts

Teaching at a computer isn't like teaching in a classroom. For one thing, you can't imprison the kids. This leads to some important new considerations.

Many schools find themselves at a crucial point in the decision to bring computers into the classroom. It's a tough area to enter because it's so complicated, and there's such an apparent confusion of paths and advice. Like the legendary firm in England whose directors debated three hours whether to build a shed for the workers' bicycles (for 18s6d), then deliberated for seven minutes the proposal to completely re-equip the mill (at a cost of several hundred thousand pounds), too many administrators are looking at the wrong problem.

When you compare a minimal useful configuration, all of the small computers that can make it in the classroom are remarkably similar in price, capability, and reliability. I don't think it's possible to make a wrong decision here. (Although my conclusions apply to any classroom computer, my examples all run on the most popular machine, Radio Shack's TRS-80.)

Software, the marching orders the computer gets to do its educational thing, is the tough nut to crack. I've seen too many computers sitting, dusty and forlorn amidst a welter of battered program tapes, in the back corners of classrooms. When I ask "Why?" I'm inevitably told, "teachers overworked . . . tape loading problems . . . (mumble mumble) . . . kids lost interest." One local school keeps its TRS-80 (and both program tapes) in a cupboard because none of the teachers will take it on. Twelve miles south, in another district, three TRS-80s hum away six hours a day every day, with little or no intervention from the teachers. What's the difference? Appropriate software.

Too often teachers, reading the woeful wails of hobbyists about "not enough memory," blow their whole budget on the machine, and find themselves software poor. It takes time to learn to program well enough that kids will enjoy running your programs . . . and anyway, it's tough to learn to program in a vacuum, with no one else's work to bounce off of. I've helped a few teachers through the lonely first years, and I'd like to share what I've learned.

Computer-Aided Instruction (CAI) and computer games have come to be treated as one-and-the-same. Programmers — usually amateurs and hobbyists with ambitious programming aims but marginal literary and educational skills — have discovered that children need to be entertained to stay with the machine, so Klingons have captured much of the available territory. Programmers fall victim to the TV spinoff syndrome: we've got a compelling subject here, guys, so let's change the story a bit, and write another program . . .

Computer-Aided Instruction (CAI) and computer games have come to be treated as one-and-the-same.

Heaven forfend that we re-open the Great Games Debate. Games are super. Anything that gets a child to relate to symbols with glee is super! Children — and big people too — require novelty and entertainment in their activities. Surprise, humor, and enlightenment make a program, or a novel, movie, whatever, successful if present, boring if absent. Examples: Battleship, the classic coordinate-based seek-and-destroy game, is a natural for the 6- to 10-year-old set, but the record-keeping involved in playing it well with paper and pencil is too complex for this notoriously scattered age group. People's Software Project (Box 158, San Luis Rey, CA 92068) offers several collections of programs, strewn amongst which are a few fine educational games. Tapes 5 and 7 ($8 each) are best for our purposes. Their version of Battleship (on tape #7), written by Harley Dyk, uses the computer to solve the record-keeping problem in an exemplary way: it's a real teaching program. It contains suspense (Will TRS-80 get me?), surprise (Haha! I hit the Battleship!), and the chance to polish strategy and see immediate results. Many children are intimidated by machines, and so a screening for bad input should be gentle; this program's universal response to user error is a loving "You goofed!" Well done, Harley.

My favorite pigeon among crummy "games" is one of the various versions of States: what is the capitol of Maine? etcetera . . . Programmers find it attractive because it presents a neatly-bounded data base with a simple relationship between elements — Dover always goes with Delaware, and vice versa. Teachers seem to like it because it purports to teach a frustrating subject without much teacher effort. So then what's the problem? It isn't much fun to run; kids get bored before they get much out of it; an atlas with pictures does the job better. Another loser is the oft-rewritten "pre-school math program," presenting math facts (3 + 4 always equals 7), then testing comprehension. Radio Shack's pathetic little phallic rocket in their Math 1 package makes my kids laugh in pity . . . right before they walk away. Robert Purser proposes "Hangman" as a candidate for an award in this category: "Here is a simple game which is better suited to pencil and paper than a computer. For the lack of anything better to do, over a hundred people have written and are selling their own computerized version of this game." Give all these guys a 1 for entertainment. (The People Software tapes have two different versions for your edification, plus a couple of versions of States and one or two elementary math testers.)

A near miss at relevancy: The Bottom Shelf's Addition program from "100 Programs." The program has been designed to do addition like a kid, adding from least significant to most. That's a wrinkle I'm ashamed to say I left out of my adding program. But a nice feature does not a great program make: it's still a testing program, and the kids walk away after a few problems. TBS's "100 Programs" is largely useless educationally; the few useful concepts are aimed at adults, not children, and need drastic revision.

A Key to good CAI is "repeat business": if a program challenges and

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Michael Potts, P.O. Box 88, Caspar, CA 95420.

Basic In A Nutshell

Name: Step-By-Step
Vendor: Program Design, Inc., 11 Idar Court, Greenwich CT 06830
Price: $49.95
Purpose: Teaches how to program a TRS-80 using BASIC
Documentation: Outstanding
Loading: OK – Level 6, not critical
Implementation: This is a case of a BASIC program that teaches BASIC programming. It starts out with the assumption that the student only knows how to turn the TRS-80 on. Three cassette tapes are mounted in the cover of a looseleaf notebook that also contains supplementary information frames. The course is divided into ten two-part lessons. From a simple PRINT "HI" through arrays and graphics to complex programs, all of the Level II commands and statements are exercised.

The instruction method consists of explanation, example, trial and testing. Commands and statements are presented and explained, examples are shown both on the screen and in the notebook, and then the student is presented with some problems to solve using the BASIC elements under discussion. If an incorrect answer is given, two more tries are allowed, and then the correct answer is displayed. Each lesson ends with a test that is administered and scored by the computer. The results are then entered into the student's progress chart. More comprehensive examinations are given at the end of Lesson 5 and at the end of the course.

Suitability: This is the kind of educational programming that personal computing needs more of. The student (my teenage son) learned much more quickly than I could have taught him, and at his own pace. However, this course isn't just for youngsters but for anyone who wants to be able to program effectively using the BASIC language. In a household where there isn't anyone to do the teaching, this course would be especially useful. I'd like to see a similar course for assembly-language programming.

Other software available from the same vendor: IQ Builders (four different kinds), Memory Builder and Story Builder.

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Step by Step also available for Apple II and Pet Apple II version also available on disks for $59.95.
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Smart, Dumb, cont'd...

intrigues, the student will come back for more. Repetition leads to mastery; it also saves the teacher repetition of program directions. In some ways — the presence of surprise, engaging fantasy, and the like — repeatability is related to entertainment. But I find the program's built-in attitude is important, too.

Even the most forbearing teacher has bad days, grumbles at students, and picks on wimps. One of the incredible qualities of the computer is that it can be programmed for infinite patience. Gentleness is a necessity: the customer is always delicate.

Star Trek is entertaining, but it's horribly frustrating for most children below age thirteen. Usually many hours are required to get good enough (and lucky enough) that you don't leave the computer depressed because you've been demoted to cabin boy, leaving 26 Klingons to destroy the Galaxy. Reinforcement value, nil. Battleship, which teaches much the same material (coordinate geometry), is much more compact and machine-efficient — although undeniably less challenging. At the age level where this lesson is most appropriate, Battleship will suffice; the more sophisticated student will consume vast hunks of computer time mastering Star Trek for an arguably marginal educational gain. The People's tapes have two versions of Stark Trek, plus a few other Klingon games for your enjoyment.

The Adventure games are in a class by themselves. In these games the player conducts the computer on a quest using two-word directives like "ENTER BUILDING" or "OPEN DOOR." Periodically, malevolent dwarves and other added distractions throw axes and knives . . . but it all takes place on the computer's display as narrative: interactive literature. The children it appeals to most are generally the non-readers, who get sucked in and end up reading despite themselves. The games are incredibly time-consuming, but the value is obvious. The grandaddy Adventure is Microsoft's version (originally run on the DEC PDP-11 mainframe computer, it's been rewritten to run on a 32K disk-based S-80, costs $30.) Scott Adams' reprises of the formula are engaging, too, and run nicely on a minimal 16K machine (Adventure International, Box 3435, Longwood, FL 32750, $15 each and also available from Creative Computing Software.) A significant part of the appeal is the marked difference between the verbal exchange of these games as contrasted with the numerical preoccupation of commoner computer games. Adding an Adventure to your library increases the flexibility of your computer twofold.

Simulations bridge the gap between games and pure education, depending on the material and the program-writer's sense of humor. "Tai-pan" is a near-perfect example of the potential for education offered by simulations: author Art Canfil has translated his own obvious love for the potential for adventure in the China trade of the 1800s into an exciting trading game, complete with marauding pirates, Wu the moneylender, and officials bent on seizing your opium. To win, the trader must parlay a modest stake into a million; the memory and calculation required are incidental to the enjoyment of the game. "Hammurabi" is a classic along the same line: the player rules a pre-Biblical realm in the fertile crescent, deciding annually how much the peasants eat, how much land is bought or sold, how much grain is planted; on these few decisions hangs the welfare of the State. Both of these games have the added attraction that big people like them, too. Games like these provide a jumping-off point for broader classroom units on trade, history, or whatever the teacher's imagination decrees; the children should note an increase in their playing skill as their grasp of the concepts improves. These programs are usually written by teachers with just this effect in mind; making the lessons real.

But a nice feature does not a great program make: it's still a testing program, and the kids walk away after a few problems.

At the far end of the spectrum are the programs (and packages of programs) which make comprehensive use of the computer as a drill-and-practice tool. Radio Shack's new K-to-8 Math Package attempts to provide such an instrument for the full range of Elementary math. This powerful series of programs — arrayed as a horizontal grouping of general number skills — 150 lessons for Kindergarten through third grade (6 programs by grade level) — and a vertical array of operations program — 70 addition, 70 subtraction, 50 multiplication, and 37 division lessons (4 programs, one for each operation) offers a reasonably broad range of individual competence within each program, making it easy to load and shuffle students through the program, while broadly challenging students across the full spectrum of the four operations up to eighth grade. The programs tread a thin line between gentleness and insult: if the child takes too long answering, she is prompted to "Try another" — a nice touch — or reprimanded — "Don't fall asleep." I was concerned that children might be offended when needled by the computer, but the machine's timing seems superb: the "Don't fall asleep" message comes along about the time the child needs a giggle. The package is expensive ($200), but it is comprehensive, providing all by itself justification for a computer lab for the math department. True: drill and practice is dull. But test results indicate it's reasonable to expect that most children will attain concept mastery two or three times faster than conventional workbook drills given adequate practice with this series of programs: it's an elegant use of the computer to solve a tough problem. A foundation package like this is an absolute necessity in any well-integrated computer program.

Finally, your software library needs to start out with the ability to "bootstrap load" (a computer term for bringing a system — in this case a human — from a state of total ignorance to usefulness) the teachers and students with enough computer knowledge to use the system. Computers have the unique and amazing ability to teach absolutely anything, including themselves. Using such a system, a receptive teacher can dedicate an afternoon a week, or a few weekends, to the task of learning to program to her own specifications, and succeed handsomely in a surprisingly short time. Radio Shack's Basic self-instruction tapes offer this capability at a modest price. It could have been done with more style and spirit, but this is a workmanlike effort.

Two last details: subscribe on your school's behalf to a computer magazine or two, and encourage the parents of a couple of your "computer heroes" to do likewise. CLOAD Magazine (P.O. Box 1267, Goleta, CA 93017, $36/year) sends monthly program tapes which will flesh out your games department, but don't count on them for much educational material. Purser's Magazine (P.O. Box 466, El Dorado, CA 95623, $12/year) consists of reviews of educational programs, and will save you the price of admission in lousy software. You'd be wise to set aside a few dollars for the right program when you see it. Given the solid foundation library you've established by following my advice, you'll be able to pick and choose.

This "shopping list" for a minimal TRS-80 software library undertakes to make two points. First: if your computer had the pick of these programs, you'd be able to settle back and let the programs come to you, confident that your computer could earn its keep educationally for at least a year. At year's end, you can expect to spend some time weeding out inferior programs in order to keep your library manageable. Second, and more important: exercise careful judgment in getting and keeping programs. Children have a tendency to play what's available: if it's Star Trek or Hangman, your computer program is being ill-used. If, on the other hand, you provide a bouquet of valid, challenging, and engaging programs to embellish a solid back-bone of instruction (like the Radio Shack K-8 Package), you have a viable computer program which will justify by any objective measure your school's expenditure and your energy. ☐

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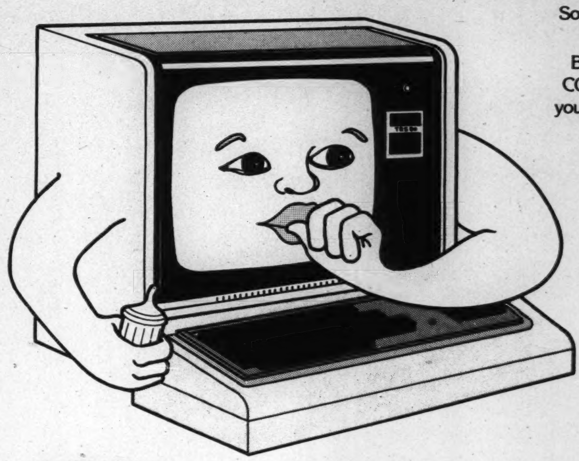

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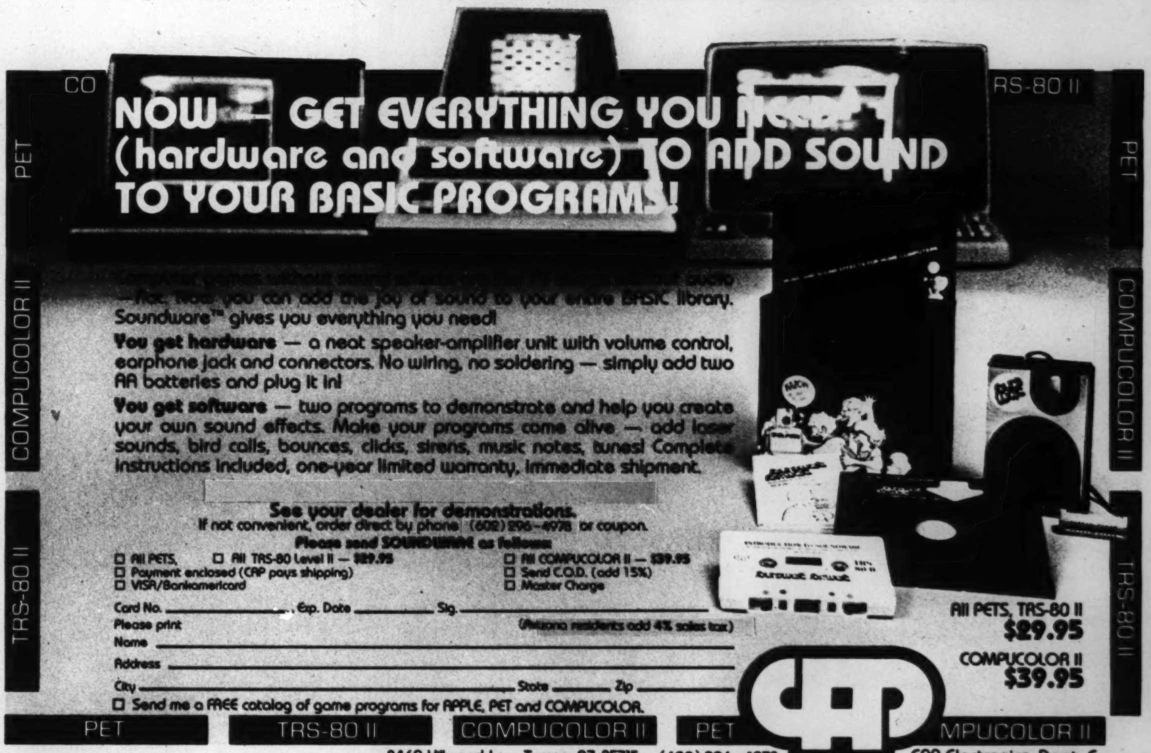

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Classroom Computers And Innovation Theory

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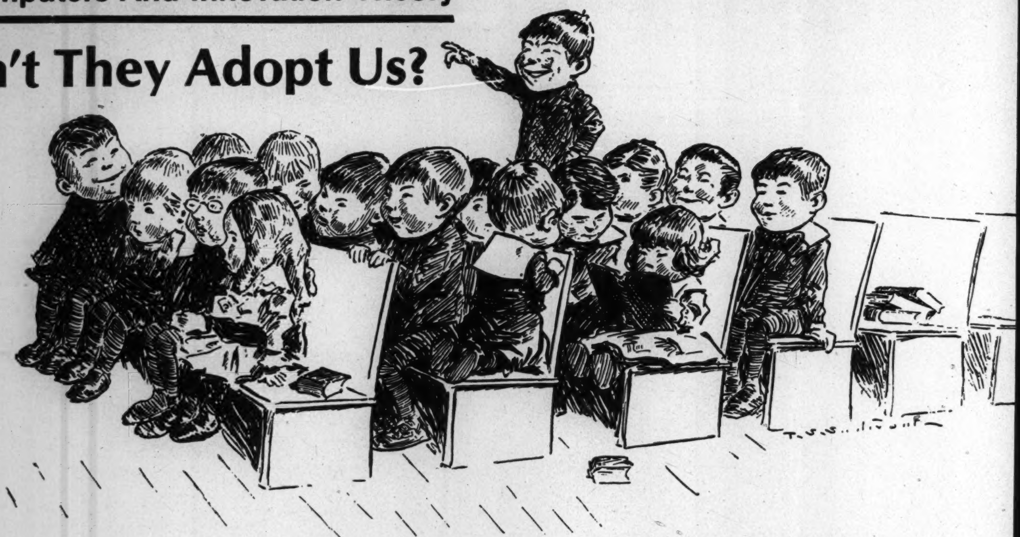

Helena C. Martellaro

We computer lovers find it hard to understand why our beloved machines are trickling into the schools so slowly . . .

Introduction

Computer-assisted instruction (CAI) has been around for a little over 15 years, but not until very recently have large numbers of educators begun seriously considering the use of computers in the classroom. In the beginning, extensive software and courseware packets were developed for large computers (PLATO, TICCIT and others). Then in the last few years a branching-out in CAI has taken place with personal computers. At present, these computers — like the Apple II, TRS-80, PET, and others — are beginning to infiltrate the schools. With these new lower-cost systems, more schools can put computers in more classes than ever before. Yet, for the most part, the average child in the average public school is still not involved with computers. It seems as though the potential is there to make the classroom a more imaginative and challenging learning environment with these computers. The question then becomes: why haven't more school children been exposed to computers?

To try to answer this question, one needs to look at the schools as a complex social system, a social system whose values, attributes and traditions affect the rate of adoption of all innovations. Public schools have long been a haven for the traditional values in society. Although there have always been a few pockets of innovative and progressive forms of education, in general the school systems have been resistant to change. Education today is much as it was one hundred years ago. The outward trappings have changed, but the three fundamental characteristics of the school — the classroom, the teacher, and the textbook — still remain.

Because of their traditional attitudes and their weariness of innovations that claim phenomenal results, many teachers are just not certain how they feel about computers. Teachers, when asked about computers, usually fall into three categories: 1) those who believe computers will dehumanize education and want computers kept out of the schools except for very controlled situations (e.g., advanced math or physics classes), 2) those who believe computers have potential in the schools, but are a little more than frightened to have computers in their classrooms, and 3) those who believe computers are the new wave of the future and want computers in their classrooms now. The majority of teachers fit into group two. It is the second group that must be positively influenced if computers are to become a major tool in education.

Attributes of Innovations

Everett Rogers and F. Floyd Shoemaker (1971) list five attributes that affect the rate of adoption of innovations. They are: 1) *relative advantage,* 2) *complexity,* 3) *trialability,* 4) *observability,* and 5) *compatibility.* From examination of these five attributes, one can delineate the barriers that must be overcome in order for computers to prevail in the schools.

The first and most important attribute is *relative advantage,* which ". . . is the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 1971, p. 139). To generalize this idea, one can think of the computer as the innovation and the idea it supersedes as the regular classroom method of teaching. In order for computers to enter the classrooms in large numbers and be used by a majority of the students, teachers must perceive the computer to be more valuable in the learning process than the old ways previously used to teach. The greater the perceived advantage, the faster the rate of adoption.

The 1984 syndrome is present either consciously or subconsciously in these teachers, and trying to explain that computers are useful tools does not always alleviate their fears.

An area of conflict lies in the fact that those teachers who do use the computer see it as a nice aid to instruction, but as an aid that can be done without if need be. This implies that the computer is not perceived as an integral part of the education process. It does not supersede another teaching method; it merely adds a dimension to the classroom, one not really

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Helena C. Martellaro, 2929 Los Amigos Ct., Apt. B, Las Cruces, NM 88001.

considered necessary for good teaching. The result is a slower rate of adoption. If computers are to breach the classroom barriers, they must be perceived as an integral part of the curriculum.

The second attribute is *complexity*. The perceived complexity of an innovation will determine how fast that innovation will be adopted. The more complex the innovation, the slower the rate of adoption. Unfortunately, computers are perceived as very complex devices.

In teacher education programs little attempt is made by prospective teachers to take a beginning computer class. If one asks why, one is told that computer courses are too difficult and irrelevant for their programs. This attitude of students in the education field will reflect on how they will feel about computers in their classrooms when they become teachers.

The perceived complexity of computers cannot be ignored. The computer is thought of as one of the most complex devices that has entered the school system in a long time. The implication of this perception is that the computer's rate of adoption in the classroom will be considerably slowed because of its complexity.

Public schools have long been a haven for the traditional values in society.

The third attribute is *trialability*, which deals with the ability to experiment with the innovation on a limited basis. If the innovation can be tried before being adopted, the rate of adoption will be increased. In the past, computers have tended to be non-trialable, i.e., you either bought the computer or terminal or you didn't. Inexpensive computers for classroom use could rarely be rented. Certain computer systems (such as PLATO, for thousands of dollars), could be — and still are — rented on a monthly basis. But most school boards are still reluctant to spend what they consider large sums of money on an innovation whose results have not been extensively examined. Today, school boards must contend with taxpayer revolts, inflation, and demands by teachers for higher salaries; which means that new equipment, such as computers, has a very low priority in the budget. This does not mean that computers will not become more prevalent in the classrooms, only that the rate of increase in classroom computers will be slowed considerably.

The fourth attribute is *observability*, which is the visibility of the results to other persons not immediately involved with the innovation.

When working with children and computers, teachers often find very dramatic results. The computer seems to ignite the students' interest in the world of learning. Trying to separate the student and the computer at the end of the class can be a formidable task. The unfortunate problem with this is that other teachers do not often get a chance to observe the results that the computer generated. Because teachers are often set apart in their classrooms, they do not often realize or appreciate what is going on in other classrooms in the same school. If the results cannot be easily seen by others, the computer is less likely to spread to other teachers.

The fifth attribute is *compatibility*, which deals with values, experiences, and needs of the adopter — the school teacher — to determine how well the innovation — the computer — will fit into the system — the school climate.

Some teachers feel threatened by computers. They feel that computers will eventually take away their jobs. Other teachers feel that computers dehumanize education because the student is not interacting with other children but with a machine. (Our culture seems to associate dehumanization with machines.) A teacher may subconsciously want to keep computers out of the classroom to hold onto what he or she considers the last vestige of the real human world. The 1984 syndrome is present either consciously or subconsciously in these teachers, and trying to explain that computers are useful tools does not always alleviate their fears. This type of teacher represents the teacher in group one mentioned previously; their values, experiences, and needs are not always compatible with computerized learning.

Another aspect of *compatibility* is the way computers are associated with past innovations. New inventions of the last 30 years for use in the schools have included educational records, films, slide/tape shows, film strips, individualized package program learning aids, and videotape recorders. The teachers were told that these new innovations would revolutionize education, make children receptive to learning, and eliminate all the ills of the old teaching methods. For the most part, unless they were made for a particular school environment (with teachers trained to use these new materials), these touted wonders came nowhere near their purported learning value. Teachers and school administrators became disenchanted, a great deal of money was poured into these devices, and often very little learning was produced.

This now leads us to the newest wonder invention: the computer.

With computers entering the classroom, many teachers and administrators are a little apprehensive. They see the computer as just another new toy that costs a great deal and may, or may not, increase learning.

Finally, the last aspect of *compatibility* is the misconception about who ought to use the computer. When the question is asked of school administrators how many students have had prolonged exposure to the computer, the percentage is usually around five to ten percent, and usually only the advanced math and science students. Ninety percent of the students have never even seen the computers or terminals in the school. The average students have the feeling that computers are only for the very bright students, and if they are average, then they have no business trying to understand computers. This misconception leaves out many students from ever being exposed to computers.

Summary

It appears that computers in education have a long, uphill struggle before they become well established in the classroom. The computer will have to have a perceived relative advantage over older, more established teaching methods before it comes into widespread use. The perceived complexity of the computer will have to be overcome either through training programs or by the teachers' constant exposure to the machines. The computers will have to be experimented with on a small scale, and then their use increased as their usefulness becomes more and more apparent to larger numbers of teachers. The results of computers in education will need to be made more observable, and every teacher should have some type of contact with the computer even if it is only minimal. And finally, the values, experiences, and needs of the teachers and students will have to slowly alter so that computers are necessarily an integral part of their learning and life. ☐

Our culture seems to associate dehumanization with machines.

Reference

Rogers, Everett and F. Floyd Shoemaker. *Communication of Innovations*. New York: The Free Press, 1971.

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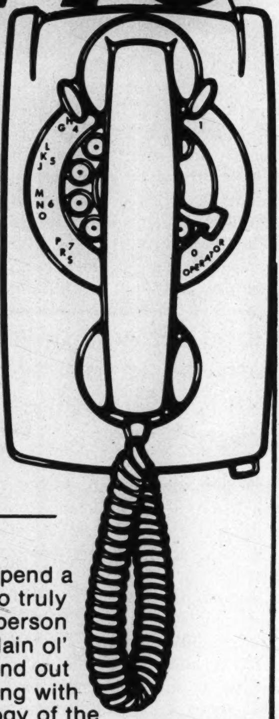

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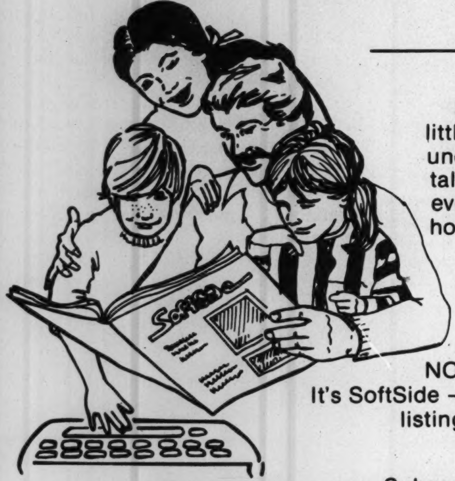

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Word Problems Made Painless

Nel Noddings

Solving story problems has long been a hated and feared task for both mathematics students and teachers. In this paper, I shall describe the development of a problem solving course that is aimed at eliminating some of the fear and dread. *Problem Solving* (Noddings, 1978) is an elementary school (grades 3-6) mathematics curriculum designed for use in Computer Assisted Instruction. Discussion will be organized around four stages in the development of the curriculum.

Stage One: The Problem with Problem Solving

Why do students have so much difficulty with word problems? The problem with word problems, some educators suggest, is reading: solve the "reading problem," and the problem with story problems will disappear (Alexander, 1960; Martin, 1963). This contention, plausible as it seems, is not strongly supported by the evidence at hand. Investigators have shown that many children with normal scores in reading still experience difficulty in solving story problems (Balow, 1964; Knifong and Holtan, 1976, 1977). Indeed, students who can read problems accurately aloud often do not know how to proceed. Hence, while it is true that youngsters who have obvious difficulty in reading will experience derived difficulty in problem solving, it is clear that other difficulties must be involved also.

In a series of studies (Loftus, 1970; Loftus and Suppes, 1972; Searle, Lorton, and Suppes, 1974), it has been suggested that structural difficulties in the problems themselves account for some student difficulties. Problems which require a large number of operations or conversion of units will be difficult; problem statements which exhibit complex surface structures or many words will be difficult; problems which differ from preceding problems will be more difficult than those which are similar to their predecessors.

Clerical and computational errors account for some of the faulty performance in problem solving (Knifong and Holtan, 1976). Further, procedural errors (Kantowski, 1977; Knifong and Holtan, 1976; Polya, 1945) loom large in the analysis of difficulty. Students often do not know how to begin, where to focus their attention, or how to monitor their own progress toward a solution.

Students who can read problems accurately aloud often do not know how to proceed.

Finally, motivational and affective factors, (Holt, 1964; Polya, 1945) enter the picture. When students lack confidence in their mathematical abilities, they often turn to nonmathematical heuristics in their attempts to solve problems. They make guesses and judge by their teachers' frowns or smiles how good the guesses are.

With these five areas of potential difficulty in mind, we could begin to describe the curriculum we want in rather holistic terms. We could even make some decisions on specific organizational matters. We decided, for example, that our problem would be presented at two or three levels of structural difficulty. The first level would use a minimum of words and state all problems simply. Higher levels would use more words and complex sentence structures. It would be possible for students to complete the entire course conceptually at the basic level. We decided also that, given mixed evidence on the "reading problem" and given that many of our users had demonstrated reading problems, our curriculum should employ a redundant vocabulary. Our idea was to keep the nonmathematical skills and peripheral information required to a minimum. But, of course, there is some risk of boredom in designing story problems with a redundant vocabulary. It was decided, therefore, to introduce some variety into the noun class where research indicates it causes little difficulty (Blankenship and Lovitt, 1976).

Procedural and effective factors concerned us greatly. CAI has obvious potential for reducing anxiety and fear. The computer does not frown, or threaten, or become exasperated with its students. We wanted to maximize this strength. Most CAI lessons end with a report informing the student how many correct and incorrect responses have been made on the day's lesson. It was decided to add to our lesson report a category "correct with help" so that a student who followed our pedagogical hints could achieve a sense of success from having done so. Assessment of this report also tells the teacher whether a particular student is profiting from the computer's instruction or whether he/she might need special encouragement from the teacher.

To cope with procedural difficulties, the curriculum was to incorporate general heuristics of problem solving and special techniques for specific problem types. This initial decision was to lead eventually to an "Alpha, Beta, Gamma" structure in our presentations. This structure, which I will

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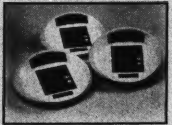

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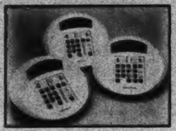

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describe later, would emphasize general problem solving heuristics at the first stage in both Beta and Gamma and specific techniques at the second stage in those sections.

Ideas for reducing clerical and computational errors arose gradually. As we began writing our problems and sought the best form for each type, we saw that the computer could be used as a model of neat and accurate computational form. Sometimes, we would require students to perform digit-by-digit computation on the computer screen; other times, we would request an answer only, and this format would require students to perform their own pencil and paper computation before responding. We hoped, of course, that this continual modeling would contribute to a reduction in computational and clerical errors.

CAI has obvious potential for reducing anxiety and fear. The computer does not frown, or threaten, or become exasperated with its students.

We were committed early, then, to a multi-level curriculum organized by structural difficulty; to an attempt to teach general and specific problem solving techniques and not to the mere presentation of problems; and to a continuing effort to encourage students in their efforts and to reduce their anxieties about story problems.

Stage Two: Basic Organization

How should the curriculum be organized? A survey of popular texts shows that story problems appear at fairly regular intervals throughout the texts and that they are organized around activity themes, e.g. "Grandmother's Farm," "A Halloween Party." This thematic organization is not very helpful in creating sequential schemes and, indeed, one finds actual repetition of problems across grade levels.

Problem Solving is organized as a "strands" curriculum. The strands are built on topics which form the central core of work on story problems appearing in widely used texts and standardized tests. If one digs below the thematic organization mentioned above, one finds characteristic mathematical questions and themes. The strands are named in just the way students and teachers usually talk about the topics:

A. How many
B. Money
C. Mystery number and age
D. Measure
E. Number system
F. Time, rate, and distance
G. Geometry

Classification of problems in current texts can be made by analyzing 1) the question asked and 2) whether or not the mathematical topic being considered is essential in the problem. Consider the problem: "John drank 2 pints of milk Tuesday and 3 pints of milk on Wednesday. How many pints did he drink altogether?" Should this problem be classified as "How many" or as "Measure"? It was decided that the measure, "pints," does not enter the problem in an essential way; that is, the reader does not need to know the meaning of "pint" in order to solve the problem. Therefore, the problem was classified as "How many." Using this sort of analysis, it was possible to survey popular texts and count the number of problems in each category. *Problem Solving* offers a representative distribution.

The next important question is how to present the problems to students. Lessons could be organized in blocks of problems from a single strand. This approach has obvious advantages. One can present the topic in textbook fashion, give examples, monitor practice. But there are disadvantages, also. In the analysis of structural difficulties, it was pointed out that students find it relatively easy to do a particular problem if it is just like its predecessor. This kind of success does not seem to represent anything significant in mathematics learning. Further, presentation in blocks seems to encourage specific techniques rather than the general heuristics we wanted to teach.

It was decided to present a mixture of problems from each active strand according to the distribution established by our survey. It was also decided, however, that whenever students got a problem wrong, they would immediately see another problem just like it. Should this happen three times in a row, mixed presentation would be automatically reactivated. The capability of producing a host of problems just like a given problem is a unique strength of computerized presentation. Since each problem is generated from a "generic form," many different problems of exactly the same form are immediately available. Further, it is most unlikely that any student will see exactly the same problem twice.

The decision to use topical strands in the curriculum organization helped greatly in the large task of sequencing problems. We could work through an entire strand from its initial activation to the end of sixth grade. Further, as the basic strands were completed, we could begin interweaving them with later strands. Thus, a "Time, rate, and distance" problem might involve subtasks that had been presented in the strands on "Money" and "Measure."

As I am describing it, the task of curriculum creation seems to be linear. It is not, of course. Right from the start, we were engaged in writing sample problems, and difficulties that arose in that task influenced the overall planning of curriculum. We worked as a team — writer, editor, and programmer — from the start, and this arrangement also influenced our planning. Problems which were not well suited to computer presentation — odd, one-of-a-kind problems — were cast out. Problems which required graphics beyond our capability were eliminated or restructured. The early stages were characterized by idea generation, argument, trying-out, and attempts to understand and appreciate the tasks of each curriculum worker. Later work, as a result of team decision making, was streamlined.

Since each problem is generated from a "generic form," many different problems of exactly the same form are immediately available.

Stage Three: The Tutorial Component

CAI programs often aim to provide practice and reinforcement. Programs that actually attempt to teach problem solving skills are relatively rare. *The Word Problem Program* of Roman and Laudato (1974) is an important example in the teaching category; it concentrates on teaching the translation of word problems into number sentences. Students are taught how to set up problems, and the computer handles the necessary computations. Clearly, an underlying assumption of this program is that the translation stage of problem solving is crucial and that it is dominantly analytic.

Problem Solving takes a different approach. First we postulate a holistic stage in problem solving — one in which the problem is grasped intuitively. At this stage students may visu-

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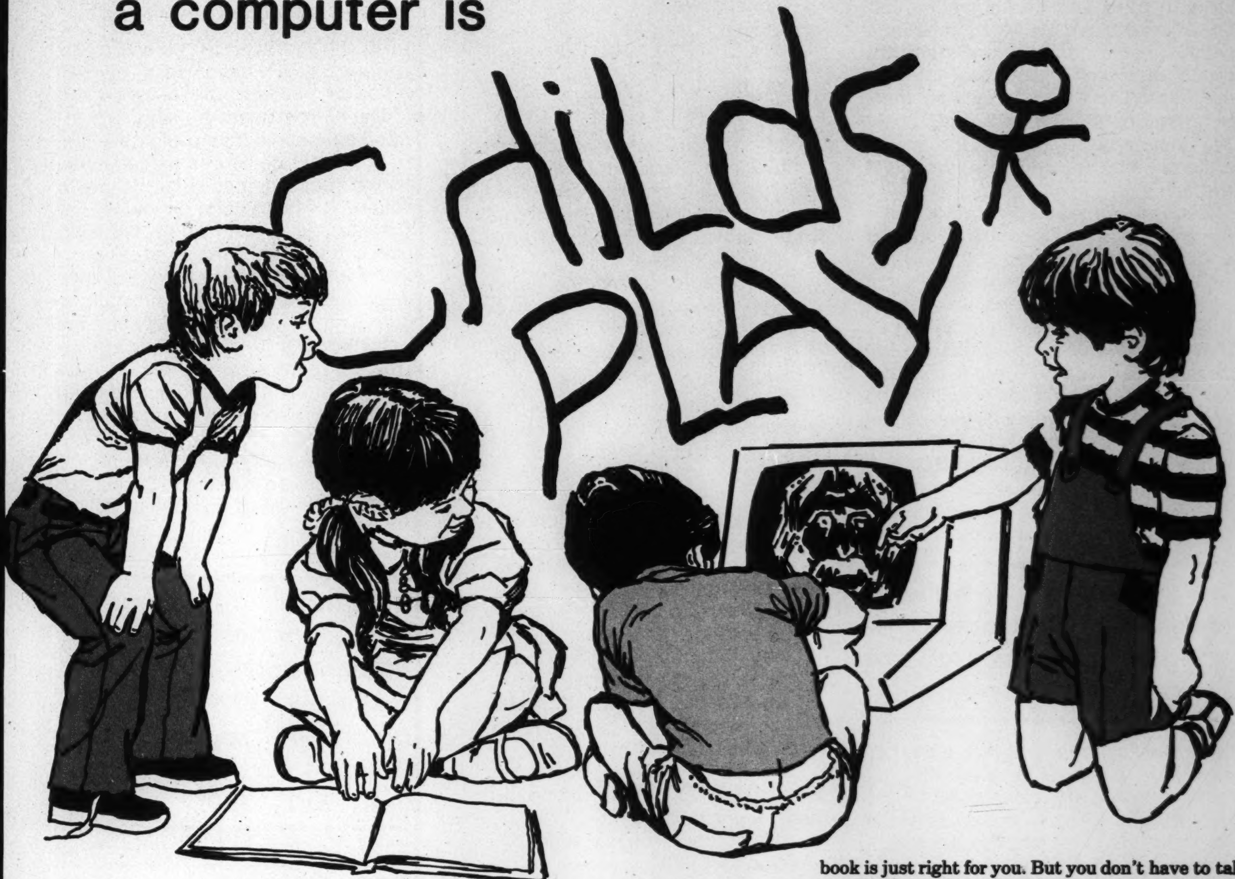

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CAI, cont'd...

alize the problematic situation. Indeed, it is entirely possible that youngsters in third and fourth grades can solve certain simple word problems without being conscious of the arithmetic operations they use in their solutions. The analytic mode so characteristic of later mathematical thinking may not be natural for young children. We decided to approach it gradually.

Second, we wanted to discourage the use of nonmathematical heuristics and algorithms in problem solving. Roman and Laudato, with the same aim, employed three techniques in their program: (1) writing problems so that cue words and phrases, i.e. "each," "divided by," were missing; (2) sequencing problems so that no two consecutive problems were alike; (3) varying the numbers so that the numbers themselves would not provide a clue to the required operation. *Problem Solving* uses the second (sequencing) technique, ignores the third, and rejects the first. In fact, a deliberate effort is made to teach children who cannot grasp the general heuristics ways in which to make use of cue expressions. We felt this technique could be important in itself, but, also, we wanted our problems to look like those children would encounter in texts and tests.

We postulate a holistic stage in problem solving—one in which the problem is grasped intuitively.

Because what goes on in the postulated holistic stage of problem solving is not well understood, it was decided to start with problems that could be solved mentally. In third and fourth grades, then, the Alpha stage of instruction simply presents a problem and requests an answer:

Alpha Stage

> Jane has 12 stamps, Kathy has 5. Jane has how many more stamps than Kathy?

Students are not asked to identify an operation at this stage, because we do not want to interfere with whatever intuitive processes may be going on. Premature concentration on the formal aspects of problem solving may lead to the sort of wild guessing and mathematical stupidity so well described by John Holt (1964).

If the student answers correctly, however, the program moves to the Beta Stage:

> Good. You got it! Which number sentence tells you how you got your answer?
>
> a. 12 − 5 = 7
> b. 12 − 5 − 6
> c. 12 + 5 − 17
> d. 13 − 6 − 7

With the reinforcement of success at the Alpha Stage, students may be ready to reflect on what they did, and how it might be described formally. If the student responds incorrectly in Beta, a hint is given:

> Think again about the numbers you used to get the answer:
> ( ) − ( ) = 7
> The student is then invited to "try again."

Throughout the Beta Stage, we try to induce "Looking back," a heuristic long endorsed by mathematics educators (Polya, 1945; Kantowski, 1977). Through this two part process — intuitive solution and reflection on formal aspects — we hope to provide a natural transition from intuitive to analytic process.

Students who answer incorrectly in Alpha are aided in the Gamma Stage:

> Let me help you. The problem asks you to find:
> a. how many stamps Kathy has
> b. how many more stamps Jane has than Kathy
> c. how many stamps Jane has.

Students who answer again incorrectly are advised:

> Read the problem again. Read the QUESTION carefully.

They are then invited to "try again." This technique — read and reread — is another general heuristic strongly recommended by mathematics educators (Earp, 1970; Blankenship and Lovitt, 1976).

In grades five and six, the order of response in Alpha and Beta is reversed. Students are now asked in Alpha to "choose an expression which tells how to find out" and in Beta to carry out the required computation. Students at this stage can handle computations which cannot be carried out mentally.

Problem Solving always requires students to complete solutions. In a later section, I shall describe the ways in which actual solutions are carried out. Here I want to emphasize that "carrying out" is seen as an important part of the holistic view of *Problem Solving*. We want students to reflect continually on the relations between means and ends. To do this thoughtfully they must live the consequences of their decisions at each stage of solution and then look back on these decisions and the results thus obtained.

Stage Four: Modes of Response

The final stage in planning for *Problem Solving* involved a consideration of modes of presentation and modes of response. Initially, we rejected a proposal that would have had the computer do all the calculations, but we realized that students could profit from instruction in using the computer as a calculator. We also wanted students to have experience with test-like situations in which they would have to perform calculations aside and respond by choosing the correct answer from a multiple choice array. So there were two experiential objectives that influenced our thinking about response modes. As a result, some problems in "Test Mode" are presented at every grade level and in every strand; problems in "Calculator Mode" begin, after instruction in use of the computer as calculator, at the fifth grade.

Premature concentration on the formal aspects of problem solving may lead to the sort of wild guessing and mathematical stupidity so well described by John Holt (1964).

As problem writing progressed, it became clear that two other modes might be very valuable. I mentioned earlier that computations could be set up on the terminal screens so that students could perform computations as they would with pencil and paper. Computations performed this way are always neatly and properly set up, and the computer performs a digit-by-digit check on computational accuracy. With Computational Mode, students do their own calculations, but the computer provides a model of clerical excellence. It is hoped, of course, that Computational Mode and Test Mode will work together toward a reduction of computational and clerical errors.

Although word problems in general are difficult for many students, some types are more difficult than others. "Measure" problems, for example, seem to be especially difficult (Knifong and Holtan, 1976). Some of the difficulty with measure may be traced to faulty or missing information. It was decided, therefore, to sup-

CAI, cont'd...

ply a "pre-problem context" for measure problems. In D 4.21, for example, students are asked:

> Which is greater, 22 hours or 1 day?

If an error is made, they are told (in Gamma):

> There are 24 hours in a day. Which is bigger,22 or 24?

We also introduced a Structural Mode to provide models of mathematical reasoning. In a text book, sample problems of this sort might or might not be actually read by the student. In *Problem Solving*, students must read the model problem, because they are required to respond by filling in blanks. Consider, for example, D 5.21:

We want students to reflect continually on the relations between means and ends.

> Jane buys a gallon of punch for a party. She drinks 1 quart before the party. How many quarts are left? Fill in the blanks:
> 1 gallon = 4 quarts
> amount Jane drinks = 1 qt.
> amount left = 3 qt.

Structural Mode is also used to model the solution of equations: C 6.51

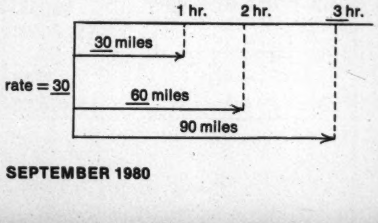
> A certain number is multiplied by 3. Then 4 is substracted from the product.
> The result is 5. Can you find the number? Choose the expression which tells how to find it:
> a. (3 × number) − 4 = 5
> b. (number × 3) + 4 = 5
> c. (4 × number) − 3 = 5

Students who answer correctly are moved to Beta:

(1) (3 × number) − 4 = 5
(2) 3 × number = 9
(3) number = 3

Structural Mode is used, again, to acquaint students with useful diagrams. In Strand F, "Time, rate and distance," instruction begins with diagrams:

> F5.11
> A car travels at the rate of 30 miles per hour. Fill in the blanks in the picture below which shows how far the car goes in 1, 2, or 3 hours.



Summarizing the decisions on problem format, several modes of presentation and response were devised to accomplish the following: provide experience with test-like situations; provide familiarity with the computer as calculator; use the computer as a model of clerical and computational excellence; use the computer as a model of mathematical reasoning; use the computer to model diagrams; provide a pre-problem context in which to familiarize students with information on units of measure.

Summary

Planning for *Problem Solving* evolved through four important stages. In Stage One, a theoretical framework was established; it was decided to view problem solving holistically. At this stage, research on problem solving difficulties was reviewed and assessed, and decisions were made to incorporate several special features in the curriculum: a redundant vocabulary, multi-level presentation to conform with what is known about structural difficulties, and an attempt to teach general heuristics of problem solving.

In Stage Two, problems of organization were studied. It was decided to use "topical strands" as the basic feature of organization, and to present students with a mixture of problems varying at every level according to an established distribution table.

In Stage Three, the tutorial component was created. A unique feature of *Problem Solving* is its gradually increasing emphasis on the formal or analytic aspects of problem solution. An Alpha, Beta, Gamma structure is used to permit instruction in both general heuristics and techniques specific to given problem types.

Finally, in Stage Four, modes of presentation and response were considered. To provide the breadth of experience that seemed both desirable and possible with CAI, four distinct modes were created: Computational, Test, Calculator, and Structural. ☐

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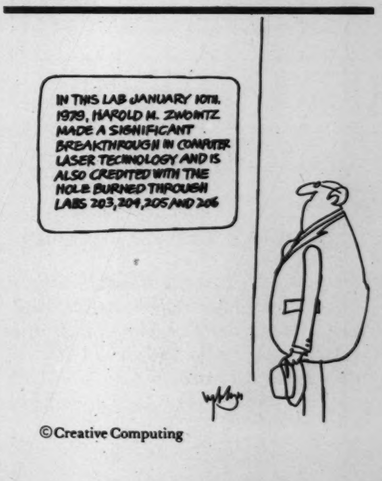
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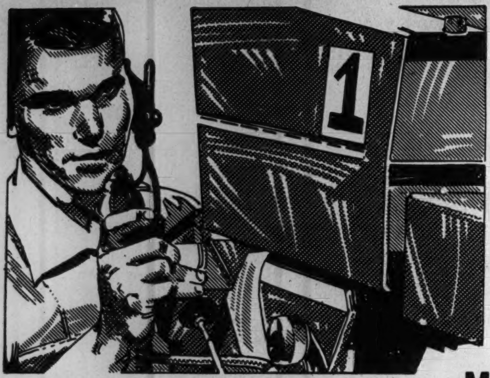

Integrating CAI & Videotape

Marc D. Schwartz

Interactive video systems provide a lively audio-visual medium to which users can actively respond. Putting together a computer and a videotape player for instructional purposes means we can present to the student teaching materials from both videotape and computer programs. Materials can appear on the screen alternately coming from one or the other device, depending on what is needed at each step in the teaching program. A simple system consists of a computer like the Apple II, a video player and a TV monitor with a connecting interface unit that permits control of the remote TV functions from the computer keyboard or from within a computer program (see Figure 1).

With a slightly more sophisticated arrangement, it is possible to search automatically for any given frame or sequence under computer control.

There are several advantages to this combination of technologies for teaching. On the one hand, videotape can present moving, colorful, visual materials; it can permit spoken descriptions, instructions or other sounds; and it can counterbalance the more formal, text-bound character of some computer-assigned instruction. On the other hand, a computer can offer branching, programmed learning; it can generate text and graphics; it can allow for easy modification of teaching materials; it can bypass what the student already knows; it can score responses, if desired; it can be programmed to start and pause the videotape at the chosen points in the presentation.

The videotape provides a more stimulating range of visual material than is possible through the use of a computer alone, and offers spoken instruction and sound effects. Review of video materials that were not clear is possible. Furthermore, video material may be searched for and played as requested, thereby permitting audio-visual learning tailored by students to their individual needs. In addition, automatic scoring and usage tabulation can indicate points of difficulty and areas successfully mastered.

Such an integrated system of computer and videotape thus provides a very flexible means of producing an interactive audio-visual presentation which can be suited to the needs of specific learners. Existing tapes can be adapted for use with such a system or new programs produced.

A Walkthrough

Let's walk through an example. Let's say a segment of videotape on a particular subject is presented to a student — for instance, a demonstration of how a piece of equipment works, or an analysis of a certain kind of group behavior, or a discussion of a computer program.

The more elaborate interface, permits random search and retrieval from certain low-cost videotape units.

After the segment is finished, the computer can be programmed to halt the video player and switch control of the TV screen to the computer, which offers textual instruction on the materials just presented.

The user may be asked to respond to questions about what has been presented, or given further information in textual or graphic form. An incorrect response will branch the program to either a presentation of helpful information (by computer-generated text), or will result in a "search to and play" a segment of video that contains the required information. Following a correct response or series of responses, the display is switched back to VTR for the next section of the program. Only after the student has shown that he or she understands the subject matter will the next segment of video instruction begin.

The program continues with alternating sections of video display and computer questions, the complete learning unit being summarized at the end of the videotape.

The Mechanics

The system must be synchronized so that video player and computer will work smoothly together. For example, the moment after a segment of video material has been completely presented, command of the TV display must be switched from video to computer and the video player paused. Following the CAI segment, the video player should be switched to FORWARD and the command of the TV display switched back to video.

Modes of Presentation

Using the first interface system, five modes of presentation of materials are feasible. These are 1) video display and sound (normal videotape operation), 2) computer display and sound from videotape, 3) computer display and no videotape sound (video player paused), 4) frozen-frame video display while the video player is on PAUSE. (This mode does not work well with some because their pause mode does not correctly frame the picture. With a player that frames correctly while on PAUSE, the mode is a useful one.) Keyboard control by the user of PAUSE or single-frame advance makes it possible to stop the video player when the user wants to look at certain materials in a more leisurely way. (One problem of the latter two modes is that if users repeatedly pause too long at one spot, the tape at that point will wear down and degrade the picture quality.)

The random-access video player, used with the second CAVRI computer interface, offers all the power of full branching capability. As well as those already mentioned, two additional presentational modes become possible: 6) a replay of a previous section of video, 7) branching forward or backward to hitherto unseen materials on the tape.

Interface packages to hook up an Apple II computer and video player in this fashions are available from CAVRI (Computer Assisted Video Recorded Instruction), 26 Trumbull Street, New Haven, CT 06511.

The simpler one, $295, permits alternation between computer and video player by starting and stopping the

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Marc D. Schwartz, 26 Trumbull St., New Haven, CT 06511.

videotape. It requires an Apple II and any videotape player/recorder having a remote control socket and two audio channels.

This interface uses brief signals at selected points on audio channel 1 of the videotape to tell the computer to switch one of the relays or go on to the next step in the program. To receive the signal, the channel 1 audio-out from the video player is run into the cassette-in socket of the computer. The computer hangs in a wait loop until it receives this signal. (Audio channel 2 is used for the normal sound track of the video program.)

The more elaborate interface, at $495, permits random search and retrieval from certain low-cost videotape units. (These are the Panasonic NV8200 and NV8170, and the Sony Betamax SLO320 and 323, SLP300 and 323, and AV 2850, 2860 and 2011.)

With a relatively low expenditure of time and money, an extensive curriculum of computer assisted teaching materials can be produced

Programmed Instructions

The computer's response to the user's answers can be of three types: the pseudo-branch (especially suited to videotape materials), the branch, and the menu. In the pseudo-branch the program proceeds in the same way after the user's response, regardless of the answer given. For example, at one point in a medical program, as X-rays of the lung were being displayed on the screen, the question was posed, "In which area of the lungs can you see pneumonia?" After waiting a few moments for the user to study the X-rays, the VP paused and control of the TV screen was switched to the computer which displayed, on the screen, the same question and four possible answers. After the user responded, regardless of the response, command of the TV display was switched back to video where the area of pneumonia was highlighted while the audio explained what characteristics of the X-ray helped identify the pneumonia as being in the mid-left lung.

A second kind of computer response to user's answers is the true branch. Here, if the user answers the question incorrectly the program branches to give him or her more information (by computer generated text) so that the question can be answered correctly. The program then returns the user to the incorrectly answered question for another try. After receiving the correct response, the program proceeds to the next step.

A third type of computer response is to offer a menu of additional information available from the computer at the user's discretion, e.g., "what tests would you like to do now, bone x-ray, cardiogram, or blood count?"

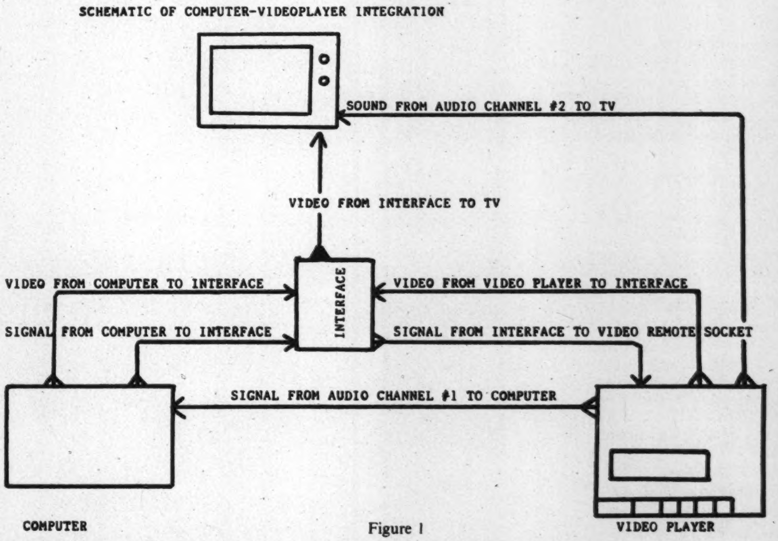
Depending on the situation, the user has the option of requesting one or more pieces of information before going on.

The Beginning of a Program

The right beginning is important for your program. One good way to begin is with a videotaped welcome to the user (spoken over a soft musical background) and a brief introduction about the program. This may be followed by an explanation of the typewriter-style keyboard, and a demonstration of how to answer questions and how to request additional information from the program as it goes along.

The user shall then be asked to carry out a few practice maneuvers. Computer-generated instructions and questions may be displayed on the screen, with the video player automatically held in PAUSE mode while the user responds via the keyboard. If the user's response is incorrect, the program branches to re-instruct him or her on the proper use of the keyboard. If the response is correct, the program moves ahead to the formal presentation of the teaching materials.

After each videotaped presentation of teaching materials, the TV display is automatically switched to computer-generated text (while the video player pauses), and the user is asked to respond to questions about what has been presented, or asked what specific additional information he or she would like. Following one or more correct responses, the video player is switched back on to preset the next segment of the program.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SIGNAL FROM INTERFACE TO VIDEO REMOTE SOCKET
SIGNAL FROM AUDIO CHANNEL #1 TO COMPUTER
COMPUTER
VIDEO PLAYER

Figure 1

An integrated system of computer and videotape provides a very flexible means of producing an interactive audio-visual presentation

Converting Previously Made Videotapes

A large number of teaching videotapes are already available. Using the method described in this article, the teaching value of those videotapes can be greatly enhanced with computer-assisted instruction by the relatively simple insertion of programmed teaching material at appropriate points on the tape.

To add computer assisted instruction to an already made videotape, I suggest the following method. Review the tape several times to select the points where CAI is to be inserted. Write the program for each CAI section. Dub the audio signals onto audio channel 1 of the videotape at the insertion points you have chosen. The tape is now ready for computer assisted/video recorded instruction.

Editing seems to go best when specific cues are selected by the author, such as a particular syllable of audio or a well-defined instant of video. (These help the author keep a chart of synchronization points for editing and review.)

Conclusion

The integration of the computer and the video player in teaching offers significant advantages. With a relatively low expenditure of time and money, an extensive curriculum of computer-assisted teaching materials can be produced or easily adapted from the large selection of video cassettes already available. The result can be a moving, complex, colorful presentation with relevant narration and sound effects, plus all the didactic power of computer-assisted instruction. □

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A Challenge for the Language Arts CAI Developer

John G. Allee, Jr.
Robert L. Williams

Language Arts CAI — grammar and usage, for example — provides the CAI developer opportunities to use the computer terminal dynamically in ways far superior to the traditional textbook, if language and the terminal are assessed and employed carefully.

Essentially, language is speech — sets of sound symbols — live, immediate oral communication among people, and these conventionalized sounds and utterances are practiced and polished almost from birth. They permeate the individual's life even before school, as they are received and interpreted by ear, produced and sent by mouth to an expanding, visible audience, personal, and interactive. Only secondarily is language writing — written symbols representing a significant portion of the sound symbols — this another kind of stylized communication that is practiced normally in schools only after age six. Although writing limitedly affects the individual's life at first, its impact increases progressively through the school years, as it is received by sight and reinforced by ear and sometimes reproduced to be sent to a limited audience that is often impersonal, static, frequently almost non-interactive so the good faith corrections and recorrections available in oral language virtually disappear. Thus, human language becomes two languages — both mutually supportive and competitive.

Reading — the receiving and interpreting of the partial speech symbols by eye — is the school's primary concern, so that failure with reading impedes or denies almost all other intellectual pursuits in our culture. Reading even significantly affects the acquisition of quantitative processes — arithmetic and mathematics — a school's second primary concern. But in order to go from speech language to written language so that there can be a mastery of language sufficient for all learning, educators have empirically found that a whole discipline of language — "grammar" — becomes a third primary concern among the skill disciplines.

From a practical point of view, grammar, or the study of language, is as necessary as it is difficult to achieve. Some of the difficulty arises, of course, because of the relative abstractness of grammar and its accompanying "seeming uselessness." Thus students (and teachers) often do not see how to apply the theory (of grammar) to the use and performance in language and the quantitative skills. In part the fault lies in all-too-partial mastery that comes not only from some lack of understanding but also from lack of practice. But how to get the necessary practice without repetition or drill? Of course, it's been said practice makes permanent, not perfect, so that the drill must be totally accurate and interesting enough to do!

Failure with reading impedes or denies almost all other intellectual pursuits in our culture.

In most language instruction — grammar and usage — the teacher strives to present language practice contextually. But even in the best of circumstances, most teaching situations are artificial — divorced, as it were, from actual lifework and play — and true context cannot be reached in either written or spoken language systems. With language, in one sense, it seems easier to address written usage since writing is stylized and static whereas speech is dynamic, personal, and considerably more dependent upon setting and expected interplay. Yet both "languages" are one language. As said before, for both the student and the teacher the two are competitive: the distinctions between them are neither easily discerned nor easily isolated for attention. However, a teacher who constantly attempts to simulate the best contextual situations for language instruction is more apt to be treating "real language" than one who does not. The teacher, by the ability to act, interact, and re-act face to face with students, can stage or simulate contexts that impart keen language insights helpful to students. Such a teacher carries language instruction far beyond the confines of the best text book. Admittedly this personal interaction is largely denied the developer of CAI.

Even though facing the same contextual needs as the classroom teacher, the developer must try to stage or simulate language contexts somewhat differently. He must transfer what would otherwise be his personal role in the classroom to the terminal.

Let's consider a problem of context that is faced by both the teacher and the CAI developer. The English articles — *a* and *the* — provide a case in point:

A1. Do you have a dog, Tom?
A2. There is a cat here, Tom.
T1. The dog is barking, Tom.
T2. There is the cat, Tom.

The two A sentences would appropriately open or initiate responses and conversations, that is, establish context. *Dog* and *cat* are identified or marked by the article *a*. On the other hand, the T sentences would normally not open or initiate communication unless previous contexts had been established by prior communication (i.e., conversation and/or physical relationships between individuals). In these sentences *dog* and *cat*, identified or marked by *the*, could be considered "valid" only if prior contexts to accept them had been established.

Now let's look at the following set of exercises typically from a traditional textbook:

Set A

Use *is* or *are* to complete these sentences.

1. The boy . . . . speaking to Tom.
2. The girl . . . . happy.
3. There . . . . a boy near Tom.
4. A girl . . . . talking to Tom.

In sentences 1 and 2 *boy* and *girl* are marked by *the;* no contexts have been

---

John G. Allee, Jr., The George Washington University, Washington D.C. 2006

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established for these nouns. In one sense for the student, it's as if he or she has been "dropped" into the middle of a conversation. Sentences 3 and 4 introduce *boy* and *girl* by marking them with *a* so that no prior contexts or antecedents are necessary. Let's see if we can get the same "drill" in but at the same time bring the sentences closer to real life language, that is, in context.

Set B

1 (3). There . . . . a boy near Tom.
2 (4). A girl . . . . talking to Tom.
3 (1). The boy . . . . speaking to Tom.
4 (2). The girl . . . . happy.

Now, *boy* and *girl* of sentences 3 (1) and 4 (2) could be assumed to have been introduced in sentences 1 (3) and 2 (4). They now have a context.

How can language arts CAI, where instances of context are crucial, overcome the difficulties?

Rather obviously these sentences have now been logically arranged to demonstrate an aspect of the English article system. In the event a classroom teacher and students were using a textbook presenting Set A and in the event the students were to raise questions about language logic, the teacher, if available of course, and if there were time for all sets of questions, would respond to these questions. Were the students considering the same exercise in a CAI lesson they most likely would not have the teacher's assistance or interaction. Thus, how can language arts CAI, where instances of context are crucial, overcome the difficulties?

The context example cited above is not as simple as it might appear at first glance.

Set C

A boy is talking to John.
The boy is also talking to Mary.

These appear acceptable. But let's pluralize *boy.*

Set D

. . . . boys are talking to John.
The boys are also talking to Mary.

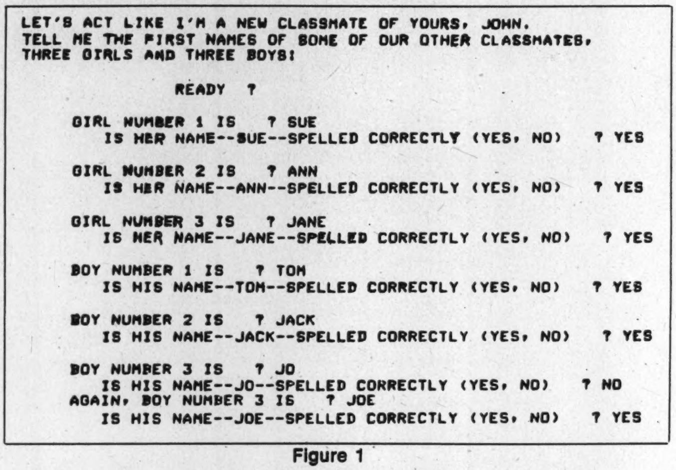
The dashes might be filled in with *some, several, three,. . .* Because the article "flows" or "branches" into other grammatical subsystems, or vice versa, in effect, the articles are also members of a larger subsystem, the determiners. The particular issue at hand (articles) and other issues (determiners) that may suddenly come into consideration demand careful analysis by the CAI developer. Language subsystems are not easily isolated for study or practice, whether for textbook, CAI, or teacher presentation. Thus, for the CAI developer, any subject matter to be presented must be studied and considered most carefully and logically. Were the developer, without cogent study, to seize upon items from traditional textbooks — items the teacher can explain (if time permits) and handle through classroom interaction, the resulting CAI exercises would unfortunately reproduce the lack of logical clarity and naturalness of the textbooks. Where traditional textbook material is transferred to individualized CAI, the limitations then become magnified.

Although not so fully as a good classroom teacher, the terminal (or CAI program) does react and interact with the student. The terminal's interaction is immediate — this is perhaps its chief asset to the student. However, the quality of interaction is limited. On the other hand, not all teachers are equally adept at language instruction and interaction or have the time to answer questions: some are excellent, others are not. One might assume also that CAI may vary in quality, but can CAI dare to be less than excellent?

In short, the terminal, first, should not simply transfer magnified limitations from textbooks. Second, the interactive powers of the terminal should be assessed carefully by the developer and used in CAI development. Moreover, since the student can be prompted by the terminal, he should be employed, wherever possible, as an active participant in developing language CAI. The student participating with the terminal, for instance, can indirectly help solve some of the problems that language instruction imposes: context — exampled by one problem noted earlier — can be made almost real by the student because the student can be asked, for example, to input characters — names of his classmates — which the terminal then can use in its presentations. In effect, the student can help develop context and can be considered an instructional assistant by the CAI developer.

Figure 1 is the first stage of a lesson that asks the student to give the names of other classmates who are then to become characters within the lesson and its exercises.

In later lessons this first stage is shortened somewhat, but it seeks the same student participation (see Figure 2).



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LET'S ACT LIKE I'M A NEW CLASSMATE OF YOURS, JOHN.
TELL ME THE FIRST NAMES OF SOME OF OUR OTHER CLASSMATES,
THREE GIRLS AND THREE BOYS!

               READY  ?

     GIRL NUMBER 1 IS   ? SUE
        IS HER NAME--SUE--SPELLED CORRECTLY (YES, NO)    ? YES

     GIRL NUMBER 2 IS   ? ANN
        IS HER NAME--ANN--SPELLED CORRECTLY (YES, NO)    ? YES

     GIRL NUMBER 3 IS   ? JANE
        IS HER NAME--JANE--SPELLED CORRECTLY (YES, NO)    ? YES

     BOY NUMBER 1 IS   ? TOM
        IS HIS NAME--TOM--SPELLED CORRECTLY (YES, NO)    ? YES

     BOY NUMBER 2 IS   ? JACK
        IS HIS NAME--JACK--SPELLED CORRECTLY (YES, NO)    ? YES

     BOY NUMBER 3 IS   ? JO
        IS HIS NAME--JO--SPELLED CORRECTLY (YES, NO)    ? NO
     AGAIN, BOY NUMBER 3 IS   ? JOE
        IS HIS NAME--JOE--SPELLED CORRECTLY (YES, NO)    ? YES
```
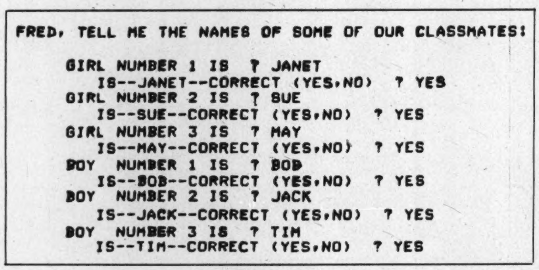

Figure 1



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FRED, TELL ME THE NAMES OF SOME OF OUR CLASSMATES!

     GIRL NUMBER 1 IS  ? JANET
        IS--JANET--CORRECT (YES,NO)  ? YES
     GIRL NUMBER 2 IS  ? SUE
        IS--SUE--CORRECT (YES,NO)  ? YES
     GIRL NUMBER 3 IS  ? MAY
        IS--MAY--CORRECT (YES,NO)  ? YES
     BOY  NUMBER 1 IS  ? BOB
        IS--BOB--CORRECT (YES,NO)  ? YES
     BOY  NUMBER 2 IS  ? JACK
        IS--JACK--CORRECT (YES,NO)  ? YES
     BOY  NUMBER 3 IS  ? TIM
        IS--TIM--CORRECT (YES,NO)  ? YES
```

Figure 2

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CAI, cont'd...

A sequence of lessons within English Usage Exercises (EUX), a CAI unit composed of stand-alone programs, teaches (1) coordinating conjunctions, (2) prepositions, (3) countable nouns, (4) articles, (5) pronoun objects of propositions, and (6) pronoun possessives. Within the pedagogical scheme of EUX, these topics interlock because the keystone is a limited set of nouns that force the student to look at and understand the article. In the prior 150+ sessions or lessons of EUX only a most limited, tangential role has been given the article, primarily because of the "difficulties" posed by the article and determiners suggested earlier.

See Figure 3 for a portion of EUX271 — Connectors

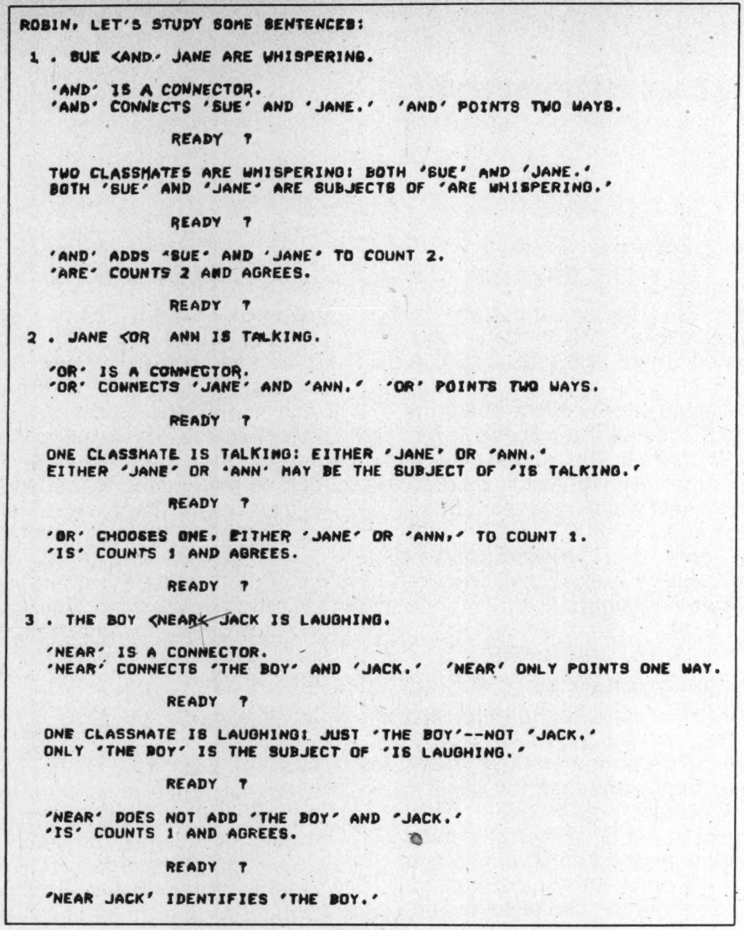
> **It's been said practice makes permanent not perfect.**

This session assumes that the student accepts the terminal as a classmate who is "speaking" or "writing" to him about other classmates within the student's (and the terminal's) own classroom context. Because the terminal has now been introduced to some other classmates, he can refer to others he's not been introduced to by citing them in/with prepositional phrases such as THE BOY NEAR . . . for example.

Pedagogically, Connectors I does not treat the article — it simply ememploys the article. It compares and contrasts two coordinating conjunctions — *and* and *or* — and a few prepositions — like *behind* and *near* — in terms of a "counting" concept established and running through major portions of EUX, where the "counting" of verbs and subjects is used to treat, among other things, verb-subject concord, illustrated in Figure 4 by the exercise of the second session of Connectors I.

As can be seen from the above, the student "counts" noun subjects, choosing the verb that agrees. The major language generality being taught is that nouns following prepositions do not alter sentence counts and/or that only and may alter "counts."

Similarly, O & S Markers I, EUX281, compares and contrasts verb and countable noun endings, the characters in the lesson being assigned by the student through the procedure shown earlier. Assuming that the student has accepted the terminal as a



```
ROBIN, LET'S STUDY SOME SENTENCES:

 1 . SUE <AND' JANE ARE WHISPERING.

   'AND' IS A CONNECTOR.
   'AND' CONNECTS 'SUE' AND 'JANE.'  'AND' POINTS TWO WAYS.

                READY  ?

   TWO CLASSMATES ARE WHISPERING: BOTH 'SUE' AND 'JANE.'
   BOTH 'SUE' AND 'JANE' ARE SUBJECTS OF 'ARE WHISPERING.'

                READY  ?

   'AND' ADDS 'SUE' AND 'JANE' TO COUNT 2.
   'ARE' COUNTS 2 AND AGREES.

                READY  ?

 2 . JANE <OR  ANN IS TALKING.

   'OR' IS A CONNECTOR.
   'OR' CONNECTS 'JANE' AND 'ANN.'  'OR' POINTS TWO WAYS.

                READY  ?

   ONE CLASSMATE IS TALKING: EITHER 'JANE' OR 'ANN.'
   EITHER 'JANE' OR 'ANN' MAY BE THE SUBJECT OF 'IS TALKING.'

                READY  ?

   'OR' CHOOSES ONE, EITHER 'JANE' OR 'ANN,' TO COUNT 1.
   'IS' COUNTS 1 AND AGREES.

                READY  ?

 3 . THE BOY <NEAR< JACK IS LAUGHING.

   'NEAR' IS A CONNECTOR.
   'NEAR' CONNECTS 'THE BOY' AND 'JACK.'  'NEAR' ONLY POINTS ONE WAY.

                READY  ?

   ONE CLASSMATE IS LAUGHING: JUST 'THE BOY'--NOT 'JACK.'
   ONLY 'THE BOY' IS THE SUBJECT OF 'IS LAUGHING.'

                READY  ?

   'NEAR' DOES NOT ADD 'THE BOY' AND 'JACK.'
   'IS' COUNTS 1 AND AGREES.

                READY  ?

   'NEAR JACK' IDENTIFIES 'THE BOY.'
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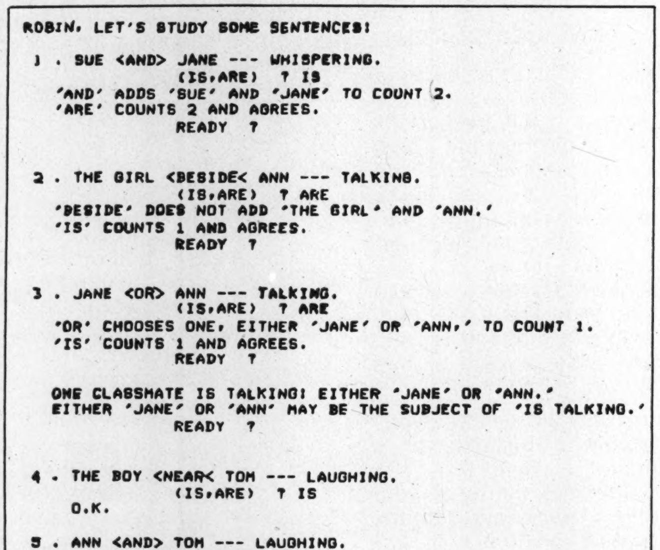
Figure 3



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ROBIN, LET'S STUDY SOME SENTENCES:

 1 . SUE <AND> JANE --- WHISPERING.
               (IS,ARE)  ? IS
   'AND' ADDS 'SUE' AND 'JANE' TO COUNT 2.
   'ARE' COUNTS 2 AND AGREES.
               READY  ?


 2 . THE GIRL <BESIDE< ANN --- TALKING.
               (IS,ARE)  ? ARE
   'BESIDE' DOES NOT ADD 'THE GIRL' AND 'ANN.'
   'IS' COUNTS 1 AND AGREES.
               READY  ?


 3 . JANE <OR> ANN --- TALKING.
               (IS,ARE)  ? ARE
   'OR' CHOOSES ONE, EITHER 'JANE' OR 'ANN,' TO COUNT 1.
   'IS' COUNTS 1 AND AGREES.
               READY  ?

   ONE CLASSMATE IS TALKING: EITHER 'JANE' OR 'ANN.'
   EITHER 'JANE' OR 'ANN' MAY BE THE SUBJECT OF 'IS TALKING.'
               READY  ?


 4 . THE BOY <NEAR< TOM --- LAUGHING.
               (IS,ARE)  ? IS
    O.K.

 5 . ANN <AND> TOM --- LAUGHING.
               (IS,ARE)  ? ARE
    O.K.
```

Figure 4

classmate within his classroom context, he interacts with the lesson material as shown in Figure 5.

The *O* and *S* marker concepts having been established in prior lessons, the student is here given noun subjects like *boy* with nouns — names of characters supplied by the student — interposed between the subjects and verbs in prepositional phrases (in these instances, nouns following prepositions do not add to the sentence "count"). But the point here is that to use nouns like *boy*, context can be simulated so that the grammatical attention given to nouns is met in "real" contextual sentences.

In a later series, after a request for classmate names, EUX311 treats noun and pronoun possessives as shown in Figure 6.

Thus, human language becomes two languages—both mutually supportive and competitive.

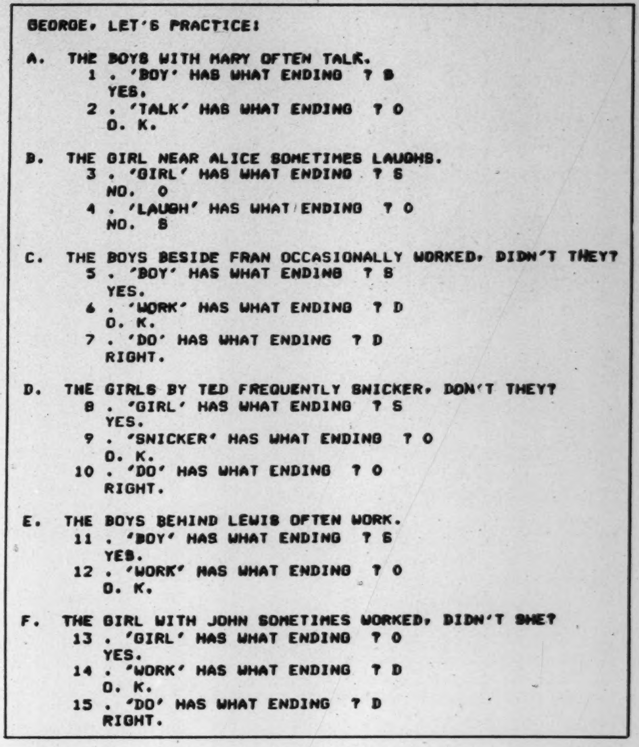
Here "context" sentences like THERE IS A GIRL WITH JANE establish contextual antecedents for the exercise sentences requesting possesive pronoun decisions since nouns like *girl* appear in the exercise sentences without identifying prepositional phrases. The syntax of the exercise sentences is varied, there being one declarative and three interrogative forms used:

THE BOY IS A PARTNER OF TOM'S.
IS THE BOY A PARTNER OF TOM'S?

ISN'T THE BOY A PARTNER OF TOM'S?
THE BOY IS A PARTNER OF TOM'S, ISN'T HE?

In summary then: (1) For many aspects of language arts CAI simulated contextual situations can be provided that are far more dynamic than the static exercises of a traditional textbook. (2) The student himself develops many of these contextual situations. (3) Thus, a most careful study and control of the subject matter is demanded of and must be preplanned by the CAI developer. (4) The terminal, through dynamic interplay, can prove far more powerful than a customary textbook, though obviously not so flexible nor as dynamic as an adept classroom teacher. And (5) the adept teacher with adept CAI, one might note, ought to compose a far better team for the instructional environment than the teacher with just a static textbook. □

Figure 5



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GEORGE, LET'S PRACTICE!

A.   THE BOYS WITH MARY OFTEN TALK.
       1 . 'BOY' HAS WHAT ENDING  ? S
         YES.
       2 . 'TALK' HAS WHAT ENDING  ? O
         O. K.

B.   THE GIRL NEAR ALICE SOMETIMES LAUGHS.
       3 . 'GIRL' HAS WHAT ENDING  ? S
         NO.  O
       4 . 'LAUGH' HAS WHAT ENDING  ? O
         NO.  S

C.   THE BOYS BESIDE FRAN OCCASIONALLY WORKED, DIDN'T THEY?
       5 . 'BOY' HAS WHAT ENDING  ? S
         YES.
       6 . 'WORK' HAS WHAT ENDING  ? D
         O. K.
       7 . 'DO' HAS WHAT ENDING  ? D
         RIGHT.

D.   THE GIRLS BY TED FREQUENTLY SNICKER, DON'T THEY?
       8 . 'GIRL' HAS WHAT ENDING  ? S
         YES.
       9 . 'SNICKER' HAS WHAT ENDING  ? O
         O. K.
      10 . 'DO' HAS WHAT ENDING  ? O
         RIGHT.

E.   THE BOYS BEHIND LEWIS OFTEN WORK.
      11 . 'BOY' HAS WHAT ENDING  ? S
         YES.
      12 . 'WORK' HAS WHAT ENDING  ? O
         O. K.

F.   THE GIRL WITH JOHN SOMETIMES WORKED, DIDN'T SHE?
      13 . 'GIRL' HAS WHAT ENDING  ? O
         YES.
      14 . 'WORK' HAS WHAT ENDING  ? D
         O. K.
      15 . 'DO' HAS WHAT ENDING  ? D
         RIGHT.
```
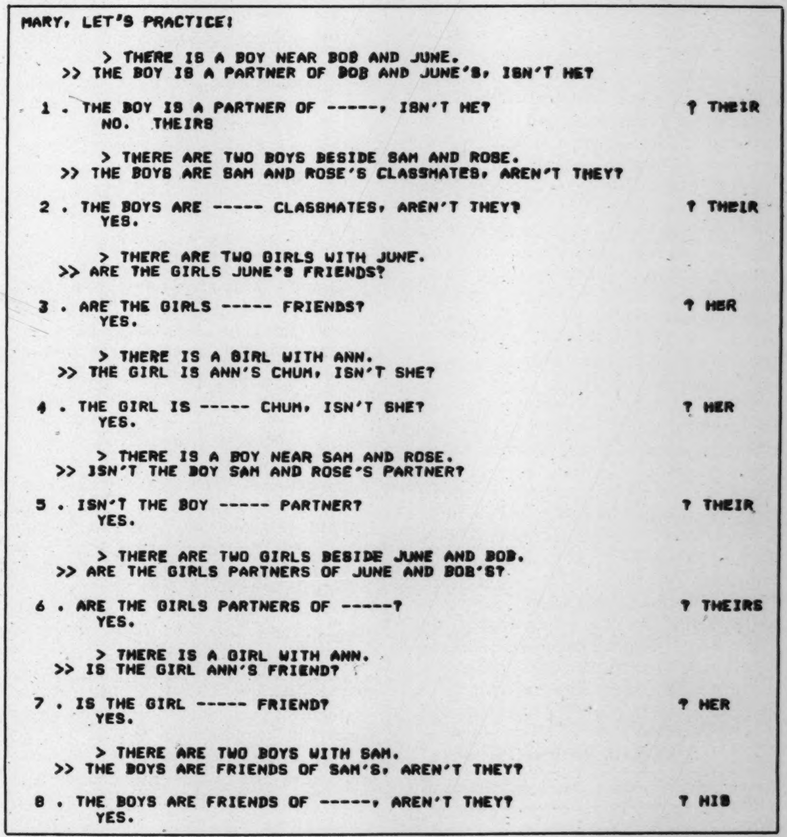

Figure 6



```
MARY, LET'S PRACTICE!

        > THERE IS A BOY NEAR BOB AND JUNE.
    >> THE BOY IS A PARTNER OF BOB AND JUNE'S, ISN'T HE?

  1 . THE BOY IS A PARTNER OF -----, ISN'T HE?                    ? THEIR
        NO.  THEIRS

        > THERE ARE TWO BOYS BESIDE SAM AND ROSE.
    >> THE BOYS ARE SAM AND ROSE'S CLASSMATES, AREN'T THEY?

  2 . THE BOYS ARE ----- CLASSMATES, AREN'T THEY?                 ? THEIR
        YES.

        > THERE ARE TWO GIRLS WITH JUNE.
    >> ARE THE GIRLS JUNE'S FRIENDS?

  3 . ARE THE GIRLS ----- FRIENDS?                                ? HER
        YES.

        > THERE IS A GIRL WITH ANN.
    >> THE GIRL IS ANN'S CHUM, ISN'T SHE?

  4 . THE GIRL IS ----- CHUM, ISN'T SHE?                          ? HER
        YES.

        > THERE IS A BOY NEAR SAM AND ROSE.
    >> ISN'T THE BOY SAM AND ROSE'S PARTNER?

  5 . ISN'T THE BOY ----- PARTNER?                                ? THEIR
        YES.

        > THERE ARE TWO GIRLS BESIDE JUNE AND BOB.
    >> ARE THE GIRLS PARTNERS OF JUNE AND BOB'S?

  6 . ARE THE GIRLS PARTNERS OF -----?                            ? THEIRS
        YES.

        > THERE IS A GIRL WITH ANN.
    >> IS THE GIRL ANN'S FRIEND?

  7 . IS THE GIRL ----- FRIEND?                                   ? HER
        YES.

        > THERE ARE TWO BOYS WITH SAM.
    >> THE BOYS ARE FRIENDS OF SAM'S, AREN'T THEY?

  8 . THE BOYS ARE FRIENDS OF -----, AREN'T THEY?                 ? HIS
        YES.
```

How To Solve It— With The Computer

Donald T. Piele

> *"A great discovery solves a great problem but there is a grain of discovery in the solution of any problem. Your problem may be modest; but if it challenges your curiosity and brings into play your inventive faculties, and if you solve it by your own means, you may experience the tension and enjoy the triumph of discovery. Such experiences at a susceptible age may create a taste for mental work and leave their imprint on the mind and character for a lifetime."*
>
> *George Polya, 1945*

These are the opening words in the preface to the first edition of Professor Polya's book *How To Solve It.*[1] Upon rereading them recently, I was struck by how well they described the mode that I prefer to use in teaching programming skills. When I have introduced computers into the classroom, I have found young students want to understand how to program a computer and enjoy the challenge of figuring out how to control it. In a small but significant way, the process of learning how to program a computer is a creative and inventive activity which exercises all aspects of the problem-solving process. Through working on programming exercises, students learn to enjoy problem-solving. Young students are especially excited about working with computers because it gives them an opportunity to test out their own ideas, something the traditional mathematics curriculum does not usually permit. Students learn that solutions to problems are not a series of rigid and meaningless operations that are blindly and uniformly followed. For this reason I believe that if small computers are used for no other function than as a vehicle for development of problem-solving skills, their use is completely justified.

The National Council of Teachers of Mathematics (NCTM) has placed the improvement of problem-solving skills as its primary objective for the 1980's. In a recent report,[2] they have recommended that:

> "1. problem solving be the focus of school mathematics in the 1980's."

The applications of these skills are not limited to mathematics but are in demand in all disciplines. Arthur Whimbey and Jack Lockhead write in the preface to their new book *Problem Solving and Comprehension*[3]*;*

> "It is fascinating to imagine what might happen to our national literacy and math competency if all teachers from elementary through college level saw one of their major roles as teaching students to think carefully in acquiring and using information from the academic disciplines. This could be done by allowing more class time for students to verbally interpret and draw conclusions from reading assignments, and explain their answers to problems they solved. When a student made an error, the teacher could guide him through a correct analysis with probing, Socratic questions, while extolling the need for completeness and accuracy."

Teachers have many preconceived ideas on the role of computers in the classroom — mainly Computer Assisted Instruction. When I suggest that a black box exists that if brought into the classroom could serve as vehicle for student interaction, invite experimentation, reward careful analysis, require reading and writing, allow cooperation among students, and reward completeness and accuracy, most teachers do not think of a computer. Even advocates of computers in the classroom seldom view computers in this role. And finally, even those who understand this role have difficulty collecting enough ideas to make it work.

Objectives

The major focus of this series, then, is to give ideas and examples that support the problem-solving role for computers in the classroom. Procedures, techniques and sample problems will be given that can be used with beginning, intermediate and advanced students. For beginning students, ideas for teaching elements of the Basic language in a discovery mode will be explained. These ideas will supplement but not replace a good manual or text on the Basic language. The ideas presented here will outline an alternative to the format used in most textbooks and should be used in conjunction with reference material on Basic for a particular system.

For intermediate and advanced students, who have a working knowledge of Basic, problems for investigation will be described and complete solutions provided in Basic. Teachers using these materials in the classroom may wish to withhold the solutions for discussion with students after they have worked on the problems. Since a great deal can be learned by seeing how others solve problems, complete listings will be provided. Most of us have learned to program this way.

The specific relationship is of little importance but the idea of looking for one is of great importance.

Lesson #1 (Beginning Students): The Process

In accord with the objectives above, the emphasis throughout this series will be on process, not answers. The personal computer is designed for interaction, and hence encourages students to experiment, revise, extend, simplify and rearrange. These are processes that are vital to problem solving. The problem that we choose to investigate will never be as important as the process that we go through to solve it. Polya's quote at the beginning of this article is the guiding principal for this series.

Keeping Records

Keeping records is very important in learning a new language and should become the primary responsibility of the student. I recommend that each student

---

Donald Piele, Associate Professor of Mathematics, University of Wisconsin - Parkside, Kenosha, WI 53141.

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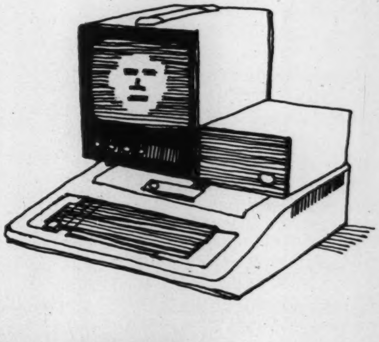

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Solve, cont'd...

have his or her own spiral notebook which will become a personal reference manual for Basic. From the very beginning, students should record information about how to operate the system — turn it on and off, enter Basic or the system monitor, load and save programs on cassette or disk. These operations are easy to demonstrate to the entire class while the students take notes on them. I have found that it is a mistake to pass out a complete summary of this information because it bypasses a skill you want to teach — recording information. This procedure also avoids what can be a big 'turn-off' in the teaching of computer programming — information overload. By having students build their own records, this problem can be minimized and, as a bonus, they will be developing a fundamental problem-solving skill.

> **It is not important that they write 'textbook' descriptions of each statement. It is more important that they record what they know in their own words.**

What follows is an example to illustrate the problem-solving approach to teaching the Basic language. The ideas expressed could be used with any system; however, for the purposes of illustration, the samples will be written for the Apple II system. Teachers with different systems can still use the format of the presentation but will need to change the programs.

Program 1 (Beginning Students)

Begin your first lesson in Basic by picking out a small program that contains three or four statements and ask the students to copy it in their notebooks. For example, if you are working with the Apple II system you might type in the following program:

```
10 GR

20 COLOR = 9

30 PLOT 20,20

40 END
```

Lots of information can be explored beginning with this simple program. For example, you may demonstrate what happens when you type LIST. Ask the students to record their own meaning for this command and to note that every statement and command must be ENTERed or RETURNed with a key stroke. The process of first demonstrating the command and then having the students record a description, in their own words, can be used effectively in the learning of any interactive computer language.

M.A.
RASSELAS

Next, RUN the program. If everything was typed in correctly, the program will produce the intended results. In this example the screen will clear and a small orange square will appear in the middle of the screen. Again, it does not matter what your program does as long as it contains a small number of fundamental statements. Use graphics whenever possible because it is easy to visualize the effect of each statement. Continue discussing the program with the class and ask for their ideas on the effect of each statement.

Sample Questions

1. The first statement in the program is 10 GR. What do you think is the effect of this statement?

2. The second statement is 20 COLOR = 9. What would happen if we changed this line to 20 COLOR = 7?

3. The third statement is 30 PLOT 20,20. What does this statement do? What would happen if we changed it to 30 PLOT 10,10? What about 30 PLOT 30,30 or even 30 PLOT 20,10? What are the limits to the values in the first and second coordinates?

4. The final statement is 40 END. What would happen if we forgot it?

RUN the program a few times to test each answer. Soon the class will formulate a working definition of each statement. It is not important that they write 'textbook' descriptions of each statement. It is more important that they record what they know in their own words. Emphasize that a program is a list of statements executed in order of increasing line number and that each statement has a certain action.

System Operation and Commands

In the discussion of the program above a number of questions about the system operation and Basic commands will naturally arise. The commands RUN and LIST will be used continuously and will need to be recorded. Specific commands such as TEXT for the Apple II, which clears the GRaphics mode and allows for the listing of the program, will become a natural part of the investigation. Questions such as how to change a line by retyping it, or how to delete or add lines to the program, are easy and natural to demonstrate in the context of this program. Finally, how to SAVE your program for later use when you will need to LOAD it again may come up in the discussion and could easily be explained at this time.

Lesson Goal

The goal of each lesson is to learn how to use the statements and commands that have been introduced and to exercise problem-solving skills. This will be done by writing a program that solves a specific problem. A typical example is:

Problem 1 (Beginning Students)
Write a program that will draw your initials in block letters on the screen.

Remarks

1. This is a clearly defined problem with a clearly defined goal and the student should have all the necessary tools to solve it. What needs to be done is to apply some problem-solving skills. Clearly, the value of the problem is not the solution but the process that each student needs to go through to solve it.

2. A fundamental skill in problem-solving is knowing how to represent information. Like most skills, it can only be developed with practice. If the problem were to represent letters on a piece of paper then the problem would be trivial because this skill has been practiced a great deal. But to carry out the same task in low resolution color graphics on the Apple II computer is quite a different problem. The student needs to first understand how positions on the screen are represented. For the Apple II the low resolution screen locations are as follows:

```
0,0  1,0  2,0 .........39,0
0,1  1,1  2,1 .........39,1
0,2  1,2  2,2 .........39,2
 .    .    .             .
 .    .    .             .
 .    .    .             .
0,39 1,39 2,39.........39,39
```

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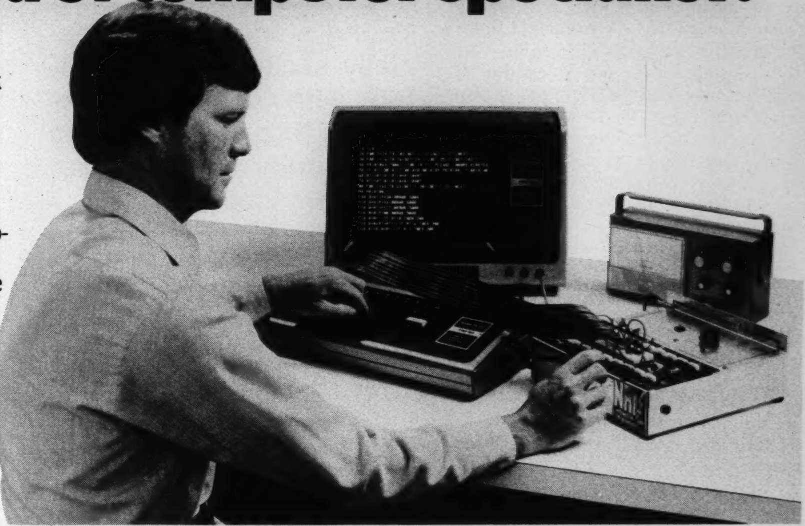

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Solve, cont'd...

Next, the student must figure out how individual letters can be composed with an arrangement of small squares in a 40x40 grid. Finally, he or she needs to understand the Basic statements which draw the letters.

3. The opportunity to work on the computer is essential. Students work successfully in pairs if there is a limited number of machines. A sign-up schedule is advisable for the available times on the system. Deadlines for the completion of each problem should be set — one or two weeks depending on the time available for each student on the computer. All work on the problem should be recorded in the notebooks and a complete listing of the final documented program should accompany every problem solution. To insure that this is followed, establish the rule that no one can continue using the computer until their work has been recorded in their notebook in a satisfactory form. It is important to establish in the beginning that the use of the computer is a privilege that can be lost to those who do not take the work seriously. The motivation to use the computer is so strong that most behavioral problems are self correcting.

Intermediate Students

For intermediate and advanced students the emphasis will be placed on problems at the junior high level and above. It is hard to establish an absolute level of difficulty since programming skills are highly dependent upon experience which, at least for now, has very little relationship to age. In the annual computer problem-solving contest at UW-Parkside, there have been cases where students in grades 7-9 have done better than the winners in grades 10-12.

Understanding the problem-solving process is still the major objective here. The emphasis given earlier on record keeping is just as important for intermediate and advanced students as for the beginning student. Again, the problem will never be as important as the experience gained in trying to solve it. Let's begin with:

Problem 1 (Intermediate Student)

Ten people show up for the first meeting of the school computer club. Each person shakes hands with every other person exactly once. Write a program that will produce a print out of all the pairs of people who shook hands with each other and the total number.

Remarks

1. A good problem solver would first try to solve this problem with a small number of people. For example, with only three or four people it would be an easy matter to list all the handshakes. Try it.

2. What is a good way to represent the solution? One simple idea is to use the first ten letters in the alphabet for the names of the ten students and print out pairs of letters such as AB, AC, etc. to represent handshakes between members. Deciding on a convenient representation is often a crucial part in successful problem-solving. Be flexible and actively pursue a number of alternatives.

Young students are especially excited about working with computers because it gives them an opportunity to test out their own ideas.

---

3. What is your plan of attack? Can you express it in words? The natural language is a high level language. Use it to express your plan of attack. For example:

> Plan of Attack
>
> "List the members in alphabetical order ABCDEFGHIJ. First A shakes hands with everyone to the right, AB, AC, AD, . . . AJ. Then B shakes hands with everyone to the right BC, BD, BE . . . BF. You continue shifting one position to the right and pairing that letter with all the remaining letters to the right. The last pairing is IJ. You never pair to the left because that handshake has already taken place. Continue until you reach the last handshake."

4. Finally, transform the plan of attack into an algorithm in Basic. A program that runs properly is evidence that the algorithm works and the plan has been carried out successfully.

Solutions

```
   Sample Solution

10 LET A$="ABCDEFGHIJ"
20 LET L = LEN(A$)
30 FOR I = 1 TO  L-1
40    FOR J = I+1 TO L
50        C=C+1
60       PRINT C," ",A$(I,I),A$(J,J)
70    NEXT J
80 NEXT I
90 END
```

Remarks

1. This program was written in North Star Basic and should be changed in line 60 for Microsoft Basic which handles strings differently.

```
60      PRINT C;" ";MID$(A$,I,1)
        ;MID$(A$,J,1)
```

2. The above program is stripped down to show only the workings of the algorithm. Students should be required to include a statement of the problem and other personal documentation at the beginning of the program.

Suppose we had phrased the problem differently:

List out all pairs of people that can be formed from a population of 10 people.

In this form it is natural to ask:

List out all groups of size 3 that can be formed from a population of 10 people.

This problem can be solved by adding another loop to the previous solution.

```
    Sample Solution

10 LET A$ = "ABCDEDFGHIJ"
20 LET L  = LEN(A$)
30 FOR I  = 1 TO L-2
40     FOR J = I+1 TO L-1
45         FOR K = J+1 TO L
50             LET C = C+1
60             PRINT C," ",A$(I,I),
                   A$(J,J),A$(K,K)
65         NEXT K
70     NEXT J
80 NEXT I
90 END
```

Remarks

1. Again this program is not complete; the output needs to be formatted.

2. As above, line 60 needs to be changed for other dialects of Basic.

The way this program is written, each time the size of the group is changed the program needs to be changed. There must be a better way to write a general program which will work for any size group. This leads to a reformulation of the problem for:

Advanced Students: Problem 1

Write a program that will list out all groups of M people that can be formed from a population of N people. For convenience you may limit N to 26. Format the output so that it prints the groupings across the page and gives the total number.

```
  First Sample Solution

 10 DIM A(26),A$(26)
 20 A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
 30  INPUT  "  ENTER  POPULATION
     SIZE, GROUP SIZE N,M ",N,M
 40 L=1 : A(L)=1 : C=0
 50 IF N-M >= A(L)-L THEN 90
 60     L = L-1
 70      IF L = 0 THEN 250
 80     A(L) = A(L) +1 \ GOTO 50
 90 IF L=M THEN 130
100     A(L+1)=A(L)+1
110     L=L+1
120     GOTO 50
130 REM ** PRINT GROUP **
140     FOR I=1 TO M
150         X=A(I) : PRINT A$(X,X),
160     NEXT I
170     PRINT
180     C=C+1
190 IF A(L)=N THEN 220
200     A(L)=A(L)+1
210     GOTO 50
220 L=L-1
230     IF L=0 THEN 250
240     GOTO 190
250     PRINT : PRINT "C(",N,",",M,
        ") = ",C
260 END
```

Remarks

1. The basic idea of this program is to build an array of length M which consists of numbers taken from 1 to N. Each number corresponds to a letter from A to Z, with 1 = A . . . 26 = Z. Thus 1234 corresponds to the group ABCD.

2. The last digit is increased until it reaches the size of N. This generates the numbers 1234, 1235, 1236 . . . 123N which correspond to the groups ABCD, ABCE, ABCF . . . ABCZ (if N = 26 and M = 4).

3. The preceding digit is now increased by one and the count continues anew: 1245, 1246, 1247 . . . 124N.

4. The numbers continue increasing in a 'speedometer like' manner until the first number is N-3. Now the last arrangement is (N-3)(N-2)(N-1)N. If N=26 this corresponds to WXYZ.

5. To carry this plan out, an array A(I) is used to hold the numbers.

6. The formatting of the output is left to the reader.

Remarks

1. This solution is written for a Basic which supports multiple line functions.

```
 Second Sample Solution

 10 DIM A$(26),B$(26)
 20 B$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
 30 A$=""
 40 INPUT "ENTER POPULATION SIZE,
    GROUP SIZE  N,M ",N,M
 50 X=FNF(0,0)
 60 PRINT : PRINT "C(",N,",",M,")
    = ",C
 70 END
 80 DEF FNF(K,I)
 90      L=LEN(A$)
100         IF L< M THEN 120
110 C=C+1 : PRINT A$ : RETURN 0
120 IF N-M < K-L THEN RETURN 0`
130      FOR I=K+1 TO N
140          A$=A$+B$(I,I)
150          X=FNF(I,0)
160          IF LEN(A$)=1 THEN A$=""
170          IF LEN(A$)>1 THEN A$=A$(1,
                     LEN(A$)-1)
180      NEXT I
190      RETURN 0
200 FNEND
```

2. The procedure begins with the empty string A$="" and builds it up to A$="ABCD" (if M=4). Once the LEN(A$)=M, the string A$ is printed out.

3. Next, drop back to A$="ABC" and build it up again starting with one letter to the right of the last one used.

4. Statement 150 X=FNF(I,O) is embedded in the definition of the function FNF. This means that FNF is defined in terms of itself, ie., recursively.

5. Recursively defined functions can be very useful as this example shows. However it is not necessary to use recursion to solve the problem as illustrated by the first solution.

6. Again, the printout has not been formatted.

A Related Problem

A simpler problem for investigation would be:

Count the number of distinct groups of M people that can be formed from a population of size N.

Remarks

1. This problem is much easier since the groups are not required to be listed.

2. There is a natural way to view this problem which uses the notion of subgoals. For example, suppose you are asked to count the number of groups of size 3 that can be formed from 5 people. Suppose you could solve the problem if the group size was one less (4). Let C(4,2) be the number of groups of size 2 that can be chosen from 4 people, and let C(4,3) be the number of groups of size 3 that can be formed from 4 people. Now if one more person, Sam, is added to the group, Sam can join all the 2 member groups to make 3 member groups. These are all the ways in which Sam can be included in a three member group. The remaining 3 member groups (C(4,3)) are those that do not contain Sam. Thus the total number of 3 member groups from 5 people is given recursively by:

```
C(5,3) = C(4,2) + C(4,3)
```

The personal computer is designed for interaction, and hence encourages students to experiment, revise, extend, simplify and rearrange.

3. This argument can be generalized to:

```
C(N,M) = C(N-1,M-1) + C(N-1,M).
```

4. This relationship shows how to express the problem in terms of two simpler problems. It is called a recursion relationship. It would be a mistake to have students simply program this relationship without understanding how it related to the proposed problem. Discussions, like the one above, plant ideas and procedures which will bear fruit in completely different situations. This specific relationship is of little importance but the idea of looking for one is of great importance.

5. One sample solution that uses this idea is:

```
 10 INPUT "POPULATION SIZE, GROUP
    SIZE  N,M = ",N,M
 20 DIM C(N,N)
 30 C(0,0)=1
 40 FOR I = 1 TO N
 50      FOR J = 1 TO I
 60        C(I,J) = C(I-1,J-1) + C(I-1,J)
 70      NEXT J
 80 NEXT I
 90 PRINT "C(",N,",",M,") = ",C(N,M)
100 END
```

6. Another sample solution that uses a function recursively is given by:

```
10 INPUT "POPULATION SIZE,GROUP SIZE
   N,M = ",N,M
20 PRINT "C(",N,",",M,") = ",FNF(N,M)
30 END
40 DEF FNF(N,M)
50     IF M=0 THEN RETURN 1
60     IF M > N THEN RETURN 0
70     Y=FNF(N-1,M) + FNF(N-1,M-1)
80     RETURN Y
90 FNEND
```

7. Try running this second solution for N=14 and M=7. You will discover a tremendous difference in time of execution of these two solutions. Ask your advanced students to explain why. The second solution is a classic example of the poor use of recursion. In the worst case the time of execution is proportional to 2^N, while in the first solution the time of execution is proportional to N^2.

8. As a final experiment, let the students keep timed records of individual runs to 'feel' the difference between 2^N and N^2.

Conclusion

Problem-solving skills cannot be acquired just by reading problems and their solutions. Sandwiched in the middle must be discussion, trial and error, modification, generalization and more discussion. These are the activities that strengthen one's ability to solve problems because they are independent of the particular problem or its setting and can be used again in completely different problem situations.

The actual solution will never be as important as the process of arriving at it. Consequently, you should not be in a hurry to dispose of problems before they have been completely used up. Whenever you find some interesting ways to further develop these or related problems, let me hear from you. I believe we need to establish better lines of communication between all of us who want to understand and teach the problem-solving process. □

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3) Whimby, A., Lockhead, J., *Problem Solving and Comprehension*, The Franklin Institute Press, 1980.

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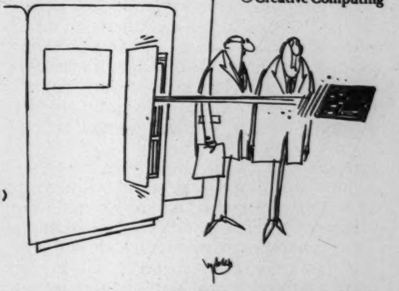

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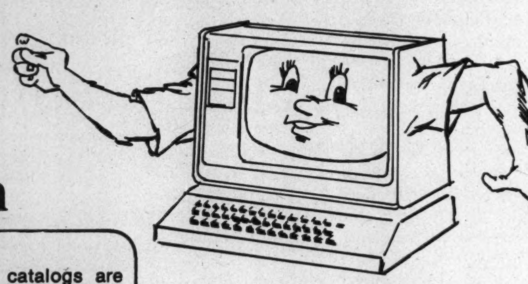

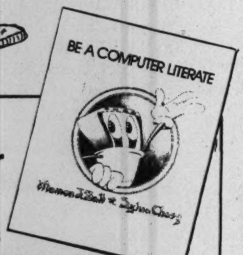
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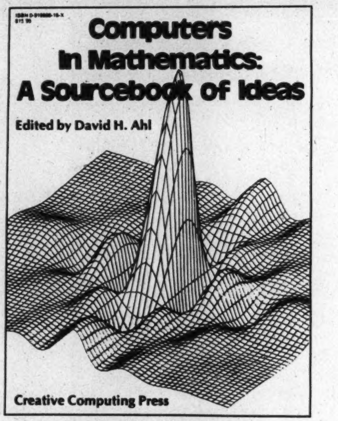

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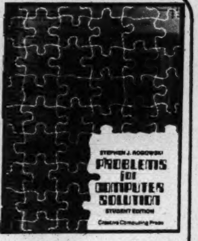

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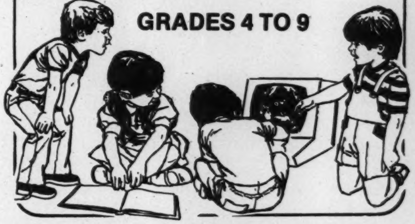

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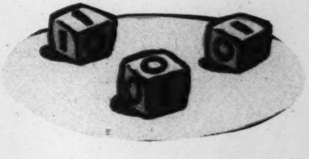

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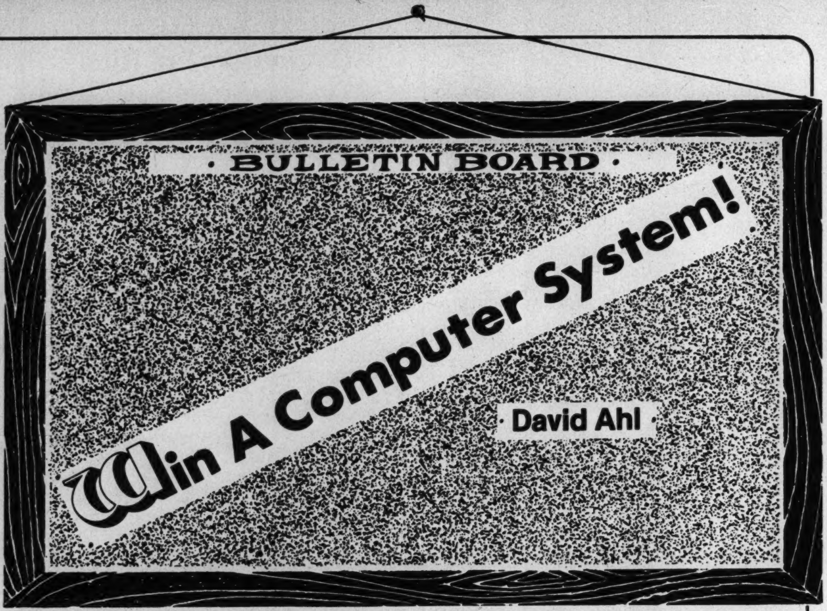

Creative Computing magazine and software are seeking an outstanding simulation which focuses on the urban transportation problem faced by many cities today.

The simulation should include Rail, Bus, Automobile.

Some Background Information

Railroads

Advantages — dense carrying capabilities, low pollution, not subject to traffic delays.

Disadvantages — initial construction very high, maintenance relatively high, uses complex mechanisms, feeder roads and parking areas needed, psychologically unacceptable to some customers (because of sparse late night schedules, fear of crime, bad connections, distance to walk).

A factor which could be either an advantage or disadvantage is that rail uses people to operate thus it provides jobs, but also it is subject to work stoppages.

Automobile

Advantages — provides point to point transportation, psychologically desirable, not subject to work stoppages.

Disadvantages — acquisition of right-of-ways expensive, inefficient carrying capacity, relatively high pollution, traffic jams and delays (due to weather, converging on one point, accidents, etc.).

Bus and/or Light Rail

Has some of the advantages and disadvantages of rail and auto.

Decisions To Be Made By The User of The Simulation

Capital Spending on new road construction, capital spending on new rail construction, operating expenditures on roads, operating expenditures on rail, operating subsidies on rail, operating subsidies for bus.

Potential Hazards

Derailment, blizzard or heavy snow, fog, strike, gas shortage, brownouts or blackouts.

Factors to be Included in the Program

To build new facilities, voters will approve a maximum tax rate increase of N %. Voters will approve a maximum rail percentage of M% and a maximum road percentage of X%. What this means is that not all taxpayers will approve of a 100% rail plan or 100% road plan so that the funding and plans must be allocated between the two. These percentages may be ranges.

Examples of What Can Happen

If spending on road construction is too high, you loose credibility and the mayor asks you to resign. If it is too low, the commuters revolt and the mayor also asks you to resign. Other things that can happen in between: If road construction expenditures are relatively high, rail commuters and environmental groups will get angry and will picket and demonstrate. If expenditures are relatively low, motorists will get angry and picket and demonstrate. There will also be no provisions for bus lanes creating many delays and the total carrying capacity will be too low. If capital expenses are high, maintenance expenses can be somewhat lower because newer facilities require somewhat lower maintenance than older facilities. If the total spending is too high, taxpayers revolt; if it is too low, companies will leave the city because of poor transportation and residential taxes will be forced up. If maintenance expending is too low on roads, that will create potholes which leads to traffic slowdowns and accidents. Other examples of what can happen include: if operating expenditures on rail are too low the schedules will not be frequent enough and trains will not connect with one another thereby stranding commuters and creating lower overall carrying capacity. The actual expenditures should bear some relationship to the transportation system for a medium size city.

What We Are Looking For

We would like a program which is instructive, which is based on fact and which is fun to use. It should run on a commonly available microcomputer such as a 16K or 32K Apple or TRS-80. It should employ graphics whenever possible and should use good programming techniques and design. The accompanying instructions should be comprehensive and should give the user a good background into the problem as well as giving the user the necessary information to make wise decisions to run the program and to learn from it. The user should probably be playing the role of the transportation commissioner of a medium size city such as Milwaukee, Sacramento or Jacksonville.

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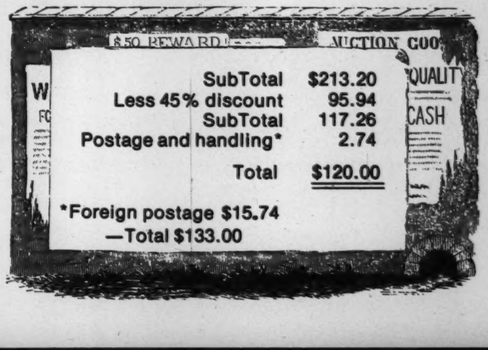

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How Not To Be Out Of Sorts

Part II: Heapsort

Albert Nijenhuis

The first part of this series of three articles discussed the insertion sort as an excellent method to sort short lists. In this part we discuss the amazing Heapsort. Its program is short, no auxiliary storage is required, and its method is intriguingly clever, though initially not simple. It was discovered by Williams and Floyd, in 1964. Our description closely follows that in "Combinatorial Algorithms" by the author and H.S. Wilf (Acad. Press), where the reader can also find a compact program in Fortran.

What Is A Heap?

For the purposes of heapsort the best way to visualize the array a(1) . . . a(n) to be sorted is shown in Figure 3. In the first row one box represents a(1), in the next row two boxes represents a(2) and a(3), etc.; each row contains twice as many array members as the previous one, until we run out ($n=26$ in Figure 3).

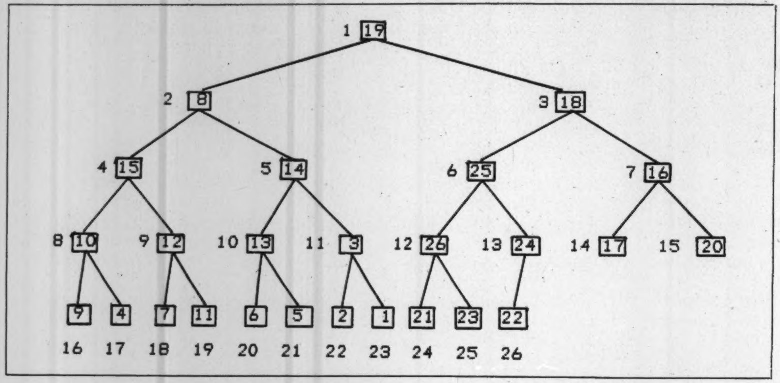


Figure 3

Each box ("father") is connected to two boxes (his "sons"), as long as the supply lasts. (The terminology precedes Women's Lib!) Figure 3 is an example of a so-called BINARY TREE, ROOTED at box 1. It is useful to observe that each box is the root of a smaller binary tree, e.g., box 5 is the root of a binary tree consisting of boxes 5, 10, 20, 21, 22, 23, while box 14 is a binary tree all by itself.

It is easy to determine the structure of a binary tree with n boxes without a picture: box i is the father of boxes 2i and 2i+1, so long as these do not exceed n.

A binary tree is called a *heap* if the elements stored in the boxes have the property that the value stored at each father is greater than, or equal to, that at each of the sons: if $2i<n$ this means $a(i) \geq a(2i)$ and $a(i) \geq a(2i+1)$, while if $2i=n$ it means only the first of these two conditions — if $2i>n$ there is no condition on the (son-less) fatherhood at box i. For example, in Figure 3 the subtrees rooted at 4 and 5 are heaps, while the tree rooted at 6 is not a heap.

Creating A Heap.

The first phase of heapsort consists in converting the binary tree into a heap. This is accomplished by a carefully designed sequence of interchanges of entries between father and son. In analogy to Part I we assume that at any time part of the desired heap structure is already present, and we shall extend it, until the whole binary tree is a heap. For example, if an interchange between a father and son is contemplated, the binary trees rooted at the sons (there may be 0, 1 or 2 of them) are already heaps. Initially, all the subtrees rooted at "son-less" fathers are heaps.

Heapsort is a very desirable candidate for a quick sorting, particularly when the input is in a state of considerable disorder.

So, suppose that the strategy calls for a possible interchange at father i; see Figure 4. Then we first compare the sons 2i and 2i+1 to find the larger one of the two; let $j=2i$ or $j=2i+1$ as the case may be (if $2i=n$, we always have $j=2i$). Next, compare a(i) an a(j). If $a(i) \geq a(j)$, the heap condition holds at box i, since the value at the father is greater or equal to that at the sons. Otherwise, we interchange a(i) and

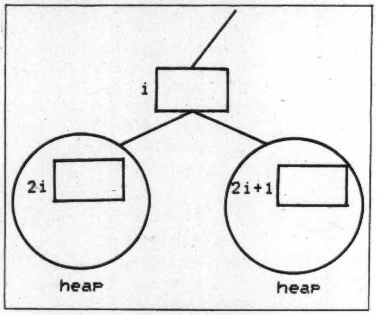
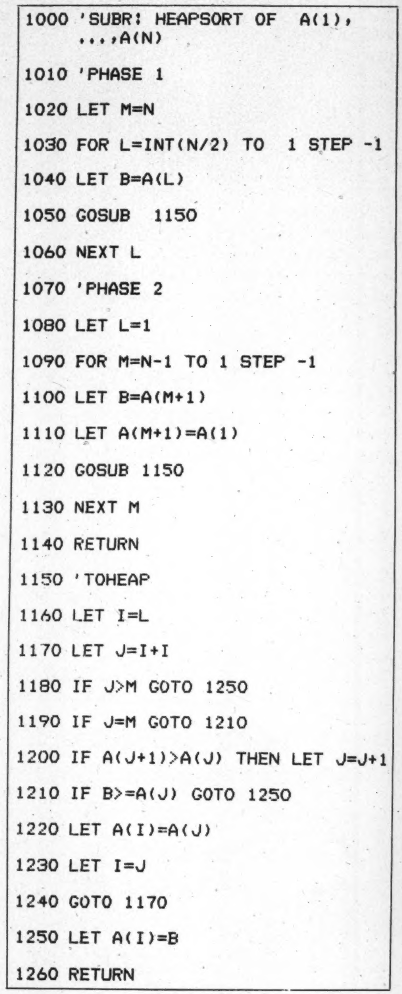


Figure 4

Albert Nijenhuis, Univ. of Pennsylvania, Dept. of Mathematics, Philadelphia, PA 19104.

a(j), thereby insuring that the new values satisfy the heap condition at box i. Note, however, that the heap condition may no longer hold at box j, since the new value is less than the old one. We may, therefore, have to readjust the situation at box j. In view of the fact that the binary trees rooted at the sons of box j are heaps, we have the same problem again, though of a smaller size. It may be hard to believe, but this one operation of father-son interchanges is the building block of the whole heapsort!



```
1000 'SUBR: HEAPSORT OF  A(1),
     ...,A(N)
1010 'PHASE 1
1020 LET M=N
1030 FOR L=INT(N/2) TO  1 STEP -1
1040 LET B=A(L)
1050 GOSUB  1150
1060 NEXT L
1070 'PHASE 2
1080 LET L=1
1090 FOR M=N-1 TO 1 STEP -1
1100 LET B=A(M+1)
1110 LET A(M+1)=A(1)
1120 GOSUB 1150
1130 NEXT M
1140 RETURN
1150 'TOHEAP
1160 LET I=L
1170 LET J=I+I
1180 IF J>M GOTO 1250
1190 IF J=M GOTO 1210
1200 IF A(J+1)>A(J) THEN LET J=J+1
1210 IF B>=A(J) GOTO 1250
1220 LET A(I)=A(J)
1230 LET I=J
1240 GOTO 1170
1250 LET A(I)=B
1260 RETURN
```

Figure 5

Referring to Figure 3, let's make a heap. First of all, the binary trees rooted at boxes 13 through 26 are (trivially) heaps. Now, first make a heap out of the subtree rooted at 13, then 12, etc., through 8. After this, continue with the binary rooted at 7, 6, etc., all the way to 1. In this last group an interchange at the root may lead to further interchanges below it, of course.

Let's follow in detail what happens at box 6. Observe that the binary trees rooted at 12 and 13 are heaps. Now a(12) > a(13), so compare a(6) and a(12), which calls for an interchange. Now compare a(24) and a(25) to find the larger one. So, compare the new a(12)=25 with a(25). Since the latter is smaller, no further interchanges are needed; otherwise, we would have interchanged the new a(12) and a(25).

Algorithm TOHEAP.

We assume that the binary tree rooted at box l has to be made into a heap, while the binary trees rooted at the sons (if any) of box l are heaps. The highest-numbered box is not to exceed m (this was n in section 6; we will see later why).

Step 1 (Initialize) Set b ← a(l); set i ← l1
Step 2 (Find a son, if any) Set j ← 2i; if j > m goto step 5
Step 3 (If there is a second son, let j be the larger one) If j=m, goto step 4, else, if a(j+1) > a(j) set j ← j+1
Step 4 (Compare b with a(j)) If b ≤ a(j) goto step 5, else (move a(j) up) set a(i) ← a(j) and i ← j, then goto step 2
Step 5 (Insert b) Set a(i) ← b, EXIT

Phase 1 (creating a heap) is now accomplished by performing TOHEAP with m=n, and with 1 running backward from [n/2] to 1. (We use [x] to denote the largest integer in x; e.g., [7.5] = 7, [6] = 6.)

We discuss the amazing Heapsort. Its program is short, no auxiliary storage is required, and its method is intriguingly clever, though initially not simple.

Heapsort, Phase 2.

So — now that we have a heap: what next? We wanted to SORT the list, didn't we? And what the heap gives us is a pile, rather strangely organized, with the largest element on top. It is not even clear where the second-largest element lives; and as to the third-largest . . . Nevertheless, in just a few lines we can describe how it all ends.

Take a(1), the largest element, and interchange with a(n). Then the largest element is where it belongs (don't touch it again!), and we now have a binary tree consisting of the boxes 1 through n-1, which is a heap, except at the root. One application of TOHEAP (1, n-1) restores the heap structure, so the (next) largest element is now in a(1). Interchange a(1) and a(n-1), and apply TOHEAP again, et. That's all!

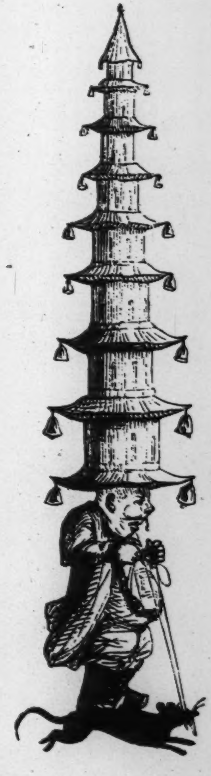
Phase 1. For l = [n/2] to 1 in steps — 1 do TOHEAP (l, n); next l
Phase 2. For m = n-1 to 1 in steps — 1 interchange a(m+1), a(1), do TOHEAP (1, m), next m; EXIT

In Figure 5 we give a Basic program for Heapsort. The subroutine TOHEAP starts at 1150. It differs from the algorithms in section 7 only in that b(=B) is defined just prior to entering the subroutine, in instructions 1040 and 1100. The loop 1030-1060 is Phase 1, while the loop 1090-1130 is Phase 2.

Final Comments.

A careful examination of TOHEAP shows that each application of this subroutine is in fact an insertion. However, the lists on which this insertion is performed are extremely short. Other methods, e.g., merge sort methods (see the next article) require even fewer comparisons, but demand their own price, e.g., additional working storage. Also, some other methods make use of any pre-existing order in the input data. In this last respect, even the insertion sort is superior.

All with all, Heapsort is a very desirable candidate for a quick sorting, without fuss, of lists of most any length, particularly when the input is (usually) in a state of considerable disorder. **(Next: Merge-sort of linked lists)** ☐



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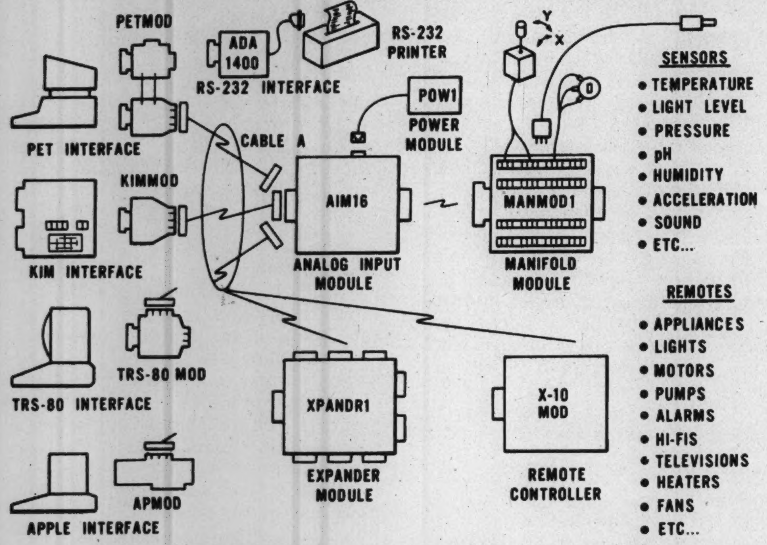
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APMOD
APPLE INTERFACE

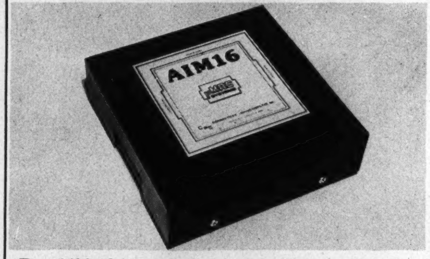
The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

Computers do not understand voltages: They understand bits. Bits are digital signals. A device which converts voltages to bits is an analog-to-digital converter.

Our AIM 16 (Analog Input Module) is a 16 input analog-to-digital converter.

The goal of Connecticut microComputer in designing the uMAC SYSTEMS is to produce easy to use, low cost data acquisition and control modules for small computers. These acquisition and control modules will include digital input sensing (e.g. switches), analog input sensing (e.g. temperature, humidity), digital output control (e.g. lamps, motors, alarms), and analog output control (e.g. X-Y plotters, or oscilloscopes).

Analog Input Module



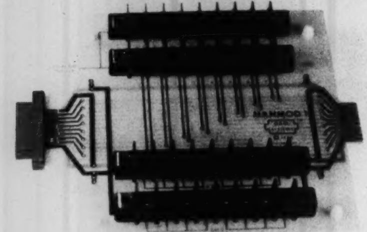
The AIM 16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the uMAC SYSTEMS special interfaces.

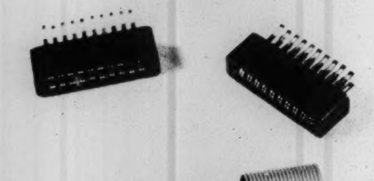
The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

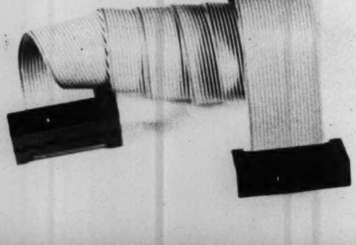
Power requirements are 12 volts DC at 60 ma.

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

Connectors





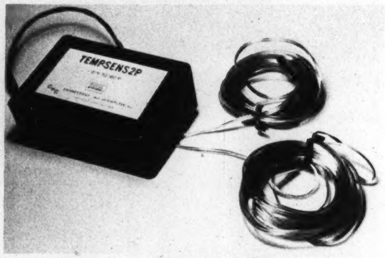


The AIM 16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable) has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the uMACSYSTEMS computer interfaces and the AIM 16 or XPANDR1 and between the XPANDR1 and up to eight AIM 16s.

TEMPSENS

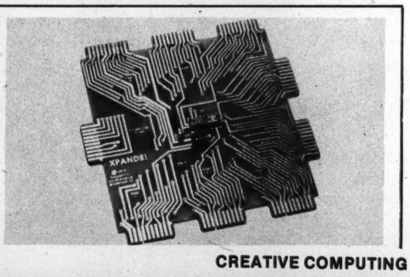

TEMPSENS2P

This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

XPANDR1

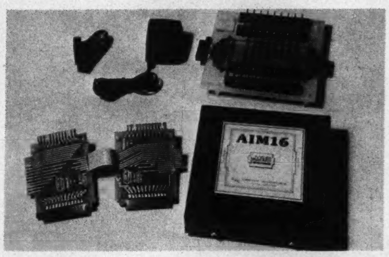
The XPANDR1 allows up to eight Input/Output modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.

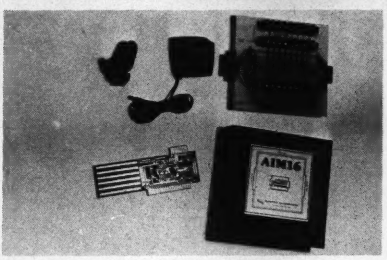


CONTROL for PET, Apple, KIM, and AIM

μMAC SYSTEMS

Computer Interfaces and Sets





For your convenience the AIM16 comes as part of a number of sets. The minimum configuration for a usable system is the AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. Both of these sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for several home computers.

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   Day of the week.
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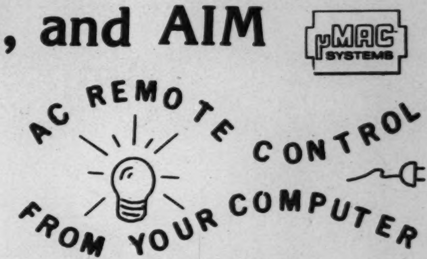
   8 outputs - TTL levels



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   Other: same as S-100
5. Self-contained module in metal case with its own power supply. Physical size approximately 5X6X2.

Price (until April 30, 1980): $199.00 (S-100), $249.00 (other)

All prices and specifications subject to change without notice. Our 30-day money back guarantee applies.

AIM16 (16 channel-8 bit Analog Input Module)	**179.00**
POW1a (POWer module-110 VAC)	**14.95**
POW1e (POWer module-230 VAC)	**24.95**
ICON (Input CONnector)	**9.95**
OCON (Output CONnector)	**9.95**
MANMOD1 (MANifold MODule)	**59.95**
CABLE A24 (24 inch interconnect cable)	**19.95**
XPANDR1 (allows up to 8 Input or Output modules to be connected to a computer at one time)	**59.95**
TEMPSENS2P1 (two temperature probes, -10°F to 160°F)	**49.95**
LIGHTSENS1P1 (light level probe)	**59.95**

The following sets include one AIM16, one POW1, one OCON and one ICON.

AIM16 Starter Set 1a (110 VAC)	**189.00**
AIM16 Starter Set 1e (230 VAC)	**199.00**

The following sets include one AIM16, one POW1, one OCON and one MANMOD1.

AIM16 Starter Set 2a (110 VAC)	**239.00**
AIM16 Starter Set 2e (230 VAC)	**249.00**

The following modules plug into their respective computers and, when used with a CABLE A24, eliminate the need for custom wiring of the computer interface.

PETMOD (Commodore PET)	**49.95**
KIMMOD (KIM, SYM, AIM65)	**39.95**
APMOD (APPLE II)	**59.95**
TRS-80 MOD (Radio Shack TRS-80)	**59.95**

μMAC SYSTEMS

Order Form

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BROOKFIELD, CONNECTICUT 06804
TEL: (203) 775-9659 TWX: 710-456-0052

The following sets include one AIM16, one POW1, one MANMOD1, one CABLE A24 and one computer interface module

PETSET1a (Commodore PET - 110 VAC)	**295.00**
PETSET1e (Commodore PET - 230 VAC)	**305.00**
KIMSET1a (KIM, SYM, AIM65 - 110 VAC)	**285.00**
KIMSET1e (KIM, SYM, AIM65 - 230 VAC)	**295.00**
APSET1a (APPLE II - 110 VAC)	**295.00**
APSET1e (APPLE II - 230 VAC)	**305.00**
TRS-80 SET1a (Radio Shack TRS-80 - 110 VAC)	**295.00**
TRS-80 SET1e (Radio Shack TRS-80 - 230 VAC)	**305.00**

QUANTITY	DESCRIPTION	PRICE	TOTAL
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Handling and shipping — add per order			$3.00
Foreign orders add 10% for AIR postage			
add 7% sales tax			
TOTAL ENCLOSED			

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Complements & Supplements

Ronald Carlson

Complements and Supplements is aimed at two groups. Math and science teachers can use the program as it is, or change the alphanumeric strings, constants, and parameters to assist with algebraic concepts in their current lessons. Also, students of different levels can benefit from the algebra involved in the solution and the structure of the program.

Since this program deals with one type of problem, only one type of solution is needed. As a math teacher I don't recommend that students use one method exclusively for solving equations, but proficiency with one method does have its advantages. The program gave my programming students an example of Computer-Assisted Instruction and my Geometry students enjoyed a chance to work together since no two problems are identical.

The problems in this program are of the following type:

An angle is

$\underline{A}\begin{cases}\text{more than}\\ \text{less}\end{cases}\underline{B}$ times its $\begin{cases}\text{supplement.}\\ \text{complement}\end{cases}$

Find the angle.

$-60 < A < 60$
B=1,2,3,4
C=1,2 (complement or supplement)

The values for A,B, and C are generated randomly, The problem is translated into the equation shown at the top of the next page.

Ronald Carlson, 44825 Kirk Ct., Canton, MI 48187.

```
RUN

 THIS PROGRAM WILL HELP YOU SOLVE ALGEBRA PROBLEMS CONCERNING
SUPPLEMENTS AND COMPLEMENTS.
 ANSWER YES IF YOU ARE GOING TO WORK AT THE COMPUTER,
 OR NO IF YOU WANT A QUIZ SHEET.
?NO
HOW MANY PROBLEMS DO YOU WANT ? 5

#  1) AN ANGLE IS  9 LESS THAN  4 TIMES ITS SUPPLEMENT .
FIND THE ANGLE .

#  2) AN ANGLE IS  57 LESS THAN  4 TIMES ITS COMPLEMENT .
FIND THE ANGLE .

#  3) AN ANGLE IS  57 LESS THAN   ITS COMPLEMENT .
FIND THE ANGLE .

#  4) AN ANGLE IS  53 MORE THAN  4 TIMES ITS COMPLEMENT .
FIND THE ANGLE .

#  5) AN ANGLE IS  9 MORE THAN  3 TIMES ITS COMPLEMENT .
FIND THE ANGLE .



 DO YOU WANT THE ANSWERS ? YES
#  1 THE ANSWER IS  142.2
#  2 THE ANSWER IS  60.6
#  3 THE ANSWER IS  16.5
#  4 THE ANSWER IS  82.6
#  5 THE ANSWER IS  69.75
READY
 THIS PROGRAM WILL HELP YOU SOLVE ALGEBRA PROBLEMS CONCERNING
SUPPLEMENTS AND COMPLEMENTS.
 ANSWER YES IF YOU ARE GOING TO WORK AT THE COMPUTER,
 OR NO IF YOU WANT A QUIZ SHEET.
?YES
HOW MANY PROBLEMS DO YOU WANT ? 5

#  1) AN ANGLE IS  57 LESS THAN   ITS COMPLEMENT .
FIND THE ANGLE .


 WHAT IS THE ANGLE ? 16.5

CONGRATULATIONS ! YOU ARE CORRECT. THE ANSWER IS  16.5

#  2) AN ANGLE IS  53 MORE THAN  4 TIMES ITS COMPLEMENT .
FIND THE ANGLE .


 WHAT IS THE ANGLE ? 7.4

TRY THE COMPLEMENT
 WHAT IS THE ANGLE ? 82.6

CONGRATULATIONS ! YOU ARE CORRECT. THE ANSWER IS  82.6
```

```
#  3) AN ANGLE IS  9 MORE THAN  3 TIMES ITS COMPLEMENT .
FIND THE ANGLE .


 WHAT IS THE ANGLE ? 45

 DO YOU KNOW THAT COMPLEMENT ARE ANGLES WITH A SUM OF  90
 WHAT IS THE ANGLE ? 35

TRY THIS EQUATION.
X=  3( 90-X) + 9
 WHAT IS THE ANGLE ? 26

 YOUR EQUATION SHOULD SIMPLIFY TO THE FOLLOWING.
 4X= 270+ 9
 WHAT IS THE ANGLE ? 75

THE CORRECT ANSWER  FOR YOUR PROBLEM IS  69.75
TRY ANOTHER PROBLEM.

#  4) AN ANGLE IS  22 MORE THAN  4 TIMES ITS COMPLEMENT .
FIND THE ANGLE .


 WHAT IS THE ANGLE ? 76.4

CONGRATULATIONS ! YOU ARE CORRECT. THE ANSWER IS  76.4

#  5) AN ANGLE IS  43 MORE THAN  4 TIMES ITS SUPPLEMENT .
FIND THE ANGLE .


 WHAT IS THE ANGLE ? 152.5

 DO YOU KNOW THAT SUPPLEMENT ARE ANGLES WITH A SUM OF  180
 WHAT IS THE ANGLE ? 152.6

CONGRATULATIONS ! YOU ARE CORRECT. THE ANSWER IS  152.6
```

$x = B\,(C*90 - x) + A$

$x = B*C*90 - Bx + A$

$Bx + x = B*C*90 + A$

$(B+1)x = B*C*90 + A$

$x = (B*C*90 + A)/(B+1)$ . . .

which is the definition of FNA, line 160.

Line 470 controls the acceptable accuracy of the user's answer. Presently it must be within .001 of the correct answer. This is to allow for such answers as 75⅓ to be entered as 75.333. Progressive hints on incorrect answers will be provided in the terminal session of this program, otherwise a list of random questions and a choice of an answer sheet for that particular quiz is printed.

Possible modifications to the program include more diagnostic work in the hint section, or variation in the wording of the problems. It would not be to difficult to change this program to handle algebra problems such as problems involving acids, bases, concentrations, gravity, etc. or, for example, Bill is 5 inches taller than Herby. Together their height is 125 inches. Find Bill's height. ☐

(Program listing on following page)

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CIRCLE 132 ON READER SERVICE CARD

Complements, cont'd...

```
LIST

10 REM ------------------------------------------
20 REM        COMPLEMENTS & SUPPLEMENTS
30 REM        R. CARLSON
40 REM        CANTON,MICH  48187
50 REM ------------------------------------------
60 REM
70 DIM R(100),A$(5),B$(8),C$(10),Q$(3)
80 PRINT" THIS PROGRAM WILL HELP YOU SOLVE ALGEBRA PROBLEMS CONCERNING"
90 PRINT"SUPPLEMENTS AND COMPLEMENTS."
100 PRINT " ANSWER YES IF YOU ARE GOING TO WORK AT THE COMPUTER,"
110 PRINT" OR NO IF YOU WANT A QUIZ SHEET."
120 INPUT Q$
130 IF Q$="YES" THEN T=1 ELSE T=0
140 INPUT "HOW MANY PROBLEMS DO YOU WANT ? ",N
150 PRINT
160 DEF FNA(A,B,C)= (A+B*C*90)/(B+1)
170 REM FNA WILL SOLVE THE EQUATION USING THE VALUES OF A,B,C
180 FOR M=1 TO N
190 A= INT(60*RND(M))+1
200 IF RND(M)<.5 THEN A=-A
210 REM A RANGES FROM -60 TO 60
220 B= INT(4*RND(M))+1
230 REM B IS 1,2,3,4
240 C= INT(2*RND(M))+1
250 REM C IS 1 OR 2 FOR COMPLEMENT OR SUPPLEMENT
260 R(M)= FNA(A,B,C)
270 REM R(M) HAS THE CURRENT ANSWER
280 IF C=1 THEN C$="COMPLEMENT" ELSE C$="SUPPLEMENT"
290 IF SGN(A)=1 THEN A$=" MORE" ELSE A$=" LESS"
300 ON B GOTO 310,330,350,370
310 B$=" "
320 GOTO 380
330 B$=" TWICE"
340 GOTO 380
350 B$=" 3 TIMES"
360 GOTO 380
370 B$=" 4 TIMES"
380 PRINT"# ";M;") ";
390 PRINT "AN ANGLE IS ";ABS(A);A$;" THAN ";B$;" ITS ";C$;" . "
400 PRINT "FIND THE ANGLE ."
410 PRINT
420 K=0
430 IF T<>1 THEN 680
440 PRINT
450 INPUT " WHAT IS THE ANGLE ? ",A1
460 PRINT
470 IF ABS(A1-R(M))> .001 THEN 510
480 PRINT"CONGRATULATIONS ! YOU ARE CORRECT. THE ANSWER IS ";R(M)
490 PRINT
500 GOTO 680
510 IF A1 <>C*90 -R(M) THEN 550
520 PRINT"TRY THE ";C$
530 GOTO 450
540 REM K IS FOR PROGRESSIVE HINTS
550 K=K+1
560 ON K GOTO 570,590,620,650
570 PRINT" DO YOU KNOW THAT ";C$;" ARE ANGLES WITH A SUM OF ";C*90
580 GOTO 450
590 PRINT"TRY THIS EQUATION."
600 PRINT"X= ";B;"(";C*90;"-X) +";A
610 GOTO 450
620 PRINT" YOUR EQUATION SHOULD SIMPLIFY TO THE FOLLOWING."
630 PRINT B+1;"X=";B*C*90;"+";A
640 GOTO 450
650 PRINT "THE CORRECT ANSWER  FOR YOUR PROBLEM IS ";R(M)
660 PRINT "TRY ANOTHER PROBLEM."
670 PRINT
680 NEXT M
690 PRINT
700 PRINT
710 IF T=1 THEN 770
720 INPUT" DO YOU WANT THE ANSWERS ? ",Q$
730 IF Q$="NO" THEN 770
740 FOR M=1 TO N
750 PRINT "# ";M;" THE ANSWER IS "; R(M)
760 NEXT M
770 END
READY
```

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Brain Games - 1 demands ingenuity.

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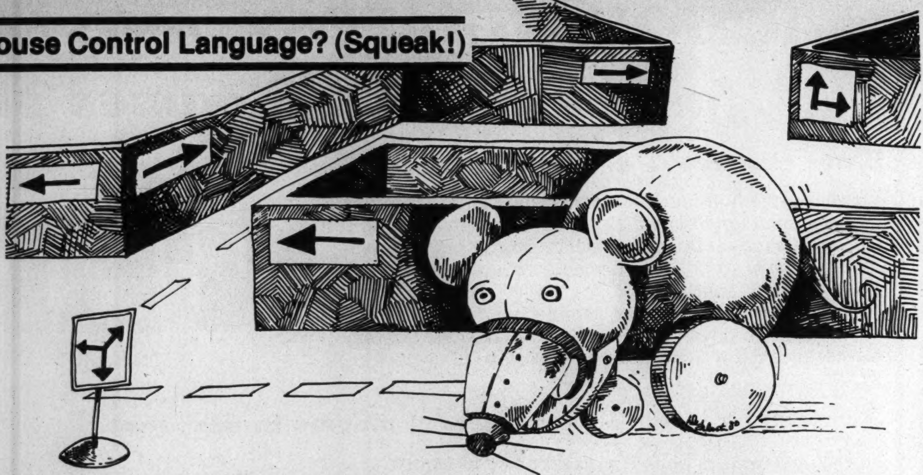
The Mechanical Mouse



Mike Tyborski

High school computer programming teachers are seldom able to challenge the student with simple, but elegant off-line problems. The classical Mechanical Mouse problem, however, can give excellent results when applied to the classroom situation. In addition, it will intrigue both novice and experienced programmers alike.

The Mechanical Mouse (CC, May/Jun 78) is simply an exercise in problem analysis and flowcharting. These are important skills that the student should learn to use effectively. Unlike many other problems, however, the Mechanical Mouse will challenge the student while retaining his interest.

The classical Mechanical Mouse problem can give excellent results when applied to the classroom situation.

These advantages were recognized by the Greendale High School computer programming teachers in Greendale, Wisconsin. As a result, they elected to use the Mechanical Mouse as a flowcharting exercise for all students. This article will show how this task was accomplished with ease.

In this exercise, each student was responsible for using a simple set of commands to give the mouse intelligence. This was to be done using previously taught flowcharting techniques and skills. An important requirement was that each mouse had to successfully run all the mazes shown in Figure 1.

Allowable commands had two major functions: motive and sensory. They were as follows:

I. Motive
  A. Move one cell in current direction.
  B. Turn right.
  C. Turn left.
  D. Turn around.
  E. Halt.
II. Sensory
  A. Facing a wall?
  B. Outside of maze?

Furthermore, two additional tests could be used if the mouse was outside the maze. They check for the entrance or exit and are used to determine if the run is completed.

A number of factors were to be examined while testing flowcharts. They determined how efficient each mouse was and allowed intelligence quotients to be given. Best efficiency, and hence performance, was defined as the least number of turns, physical moves and executed statements.

Time considerations, however, did not allow each program to be hand checked. This obstacle led to the development of a simple mouse control language that could be implemented on the school timeshare computer system. This language, or MCL for short, is based upon PILOT and consists of twelve commands. These commands are simple to use and allow programs to be written quite easily because they are directly related to those allowed in the flowcharts.

Mouse control language syntax, like PILOT, is also very easy to learn and remember. This was shown when two students taught their class MCL within 15 minutes.

Each MCL command, as shown in Figure 2, consists of one letter and is followed by a colon. In addition, branch instructions use another letter as the destination label. This label must be placed immediately after the colon because no spaces are allowed.

Mouse control language syntax, like PILOT, is very easy to learn and remember.

As an example, Figure 3 shows a simple flowchart and its MCL equivalent.

These MCL equivalents were tested by an interpreter. This interpreter was written by an advanced programming student in Fortran-20 (a modified Fortran-IV). Equally important, a simple text editor was also included in the package.

This text editor proved to be extremely versatile and useful. It featured 8 commands and allowed various maze files to be used. These commands were execute, load program, list program, load maze, reset counters, insert, delete and stop. Each was specified by a single numeric argument in the range 0 to 7. Finally, operating instructions were available through a HELP file.

Michael Tyborski, 5937 Sugarbush Lane,
Greendale, WI 53129

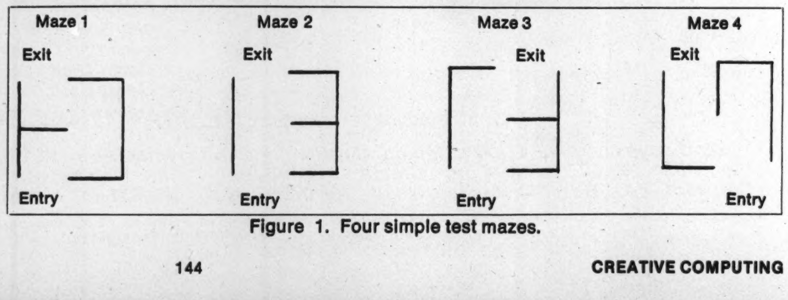


Figure 1. Four simple test mazes.

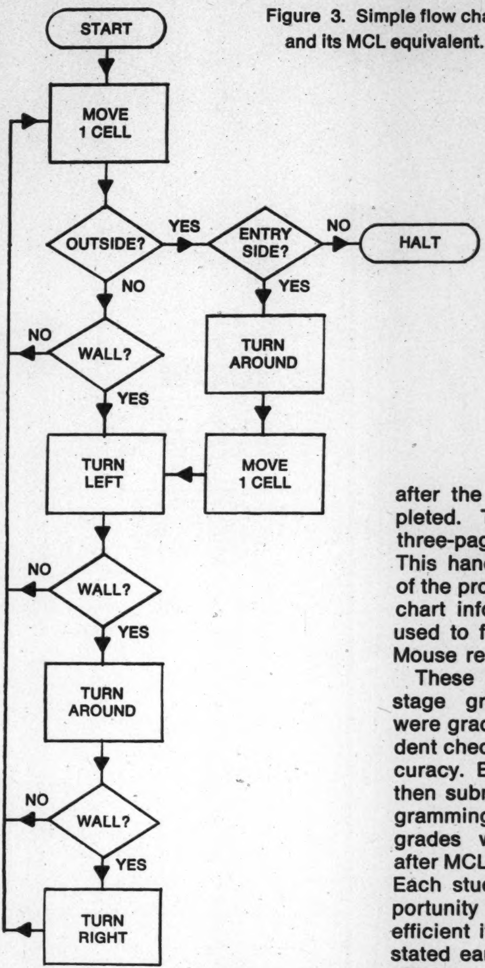


Figure 3. Simple flow chart and its MCL equivalent.

```
MCL LISTING
A M:
  O:
  Y:C
  W:
  N:A
B L:
  W:
  N:A
  A:
  W:
  N:A
  R:
  J:A
C B:
  N:D
  A:
  M:
  J:B
D H:
```

The companion interpreter was also very effective. It handled all 12 MCL commands and calculated how efficient each mouse was. Equally important, it included various error traps and their associated messages.

Finally, the assignment was given after the MCL interpreter was completed. This was done through a three-page handout and short lecture. This handout included a description of the problem, helpful hints and flowchart information. Lecture was then used to further illustrate Mechanical Mouse requirements.

Figure 2.
Mouse control language commands.

COMMAND	MEANING
M:	Move one cell in current direction
R:	Pivot right
L:	Pivot left
A:	Turn around
H:	Halt
O:	Outside of maze?
B:	At Beginning of maze?
E:	At exit of maze?
W:	Facing wall?
Y:x	Yes conditional
N:x	No conditional
J:x	Unconditional branch

These requirements led to a two-stage grading system. Flowcharts were graded first by having each student check a classmate's work for accuracy. Each acceptable result was then submitted to the computer programming teacher for check off. Final grades were eventually calculated after MCL equivalents were evaluated. Each student, however, had the opportunity to make his flowchart more efficient if needed. These grades, as stated earlier, were based on mouse efficiency.

The Mechanical Mouse problem proved to be an extremely valuable off-line exercise in flowcharting techniques. More importantly, it taught the student real world problem solving while showing that computers are not just overgrown calculators.

The author would like to personally thank Mr. Gary Luck and Mr. Arne Engebretsen, computer programming teachers, for their excellent work in making the Mechanical Mouse a reality. Special thanks are also given to Tom Gorski, junior, for his fine MCL interpreter. ☐

A complete listing of the Mouse Control Language editor/compiler in Fortran IV is available from the author for $2.00, to cover production and handling costs. Please address requests for the listing to:

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CIRCLE 118 ON READER SERVICE CARD

The Student Gets A Break

Grading Made Easy

Bruce D. Barnett

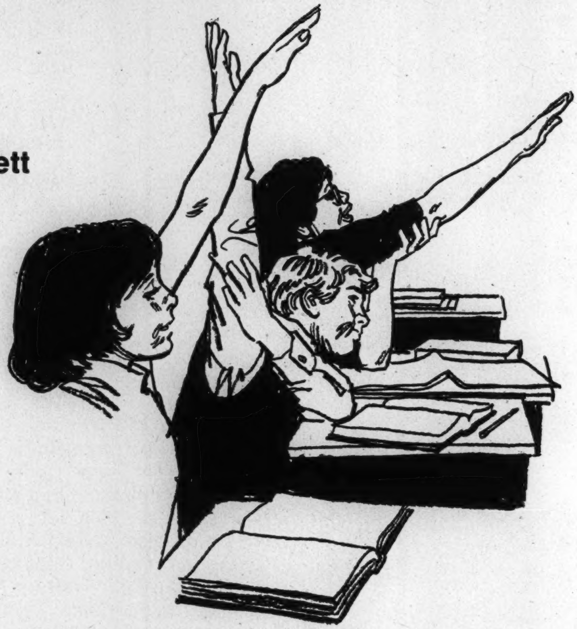
This article, of interest to teachers and students alike, presents a grading scheme that not only makes grading easier, but also gives the student a 'break.' A computer program that performs the computations involved is provided and described.

"It's fair," "I think it is a good scheme," are typical responses to the grading system I've successfully used over the past several years. It is based on a combination of three elements: homework, in-term tests, and a final examination. A computer makes the necessary combination of all scores involved easy, and in the process makes some allowance for the student who happened to have a "bad day."

When you first use the computer program at the end of the semester, enter the 'perfect score' for each homework assignment as well.

To use the grading scheme, you must first decide how you wish to weight the three elements mentioned above. I found weighting the homework 20% and applying a 30% and a 50% weight to the remaining two elements very satisfactory. The student gets a break in that the higher weight (50% in my case), goes to the higher of either the final exam grade or the average of the in-term tests. The 30% weight naturally goes to the remaining grade. Figure 1 illustrates the calculations for each of two students.

Since the final exam grade for student A was higher than the average of the two test scores (=74), the final exam score was weighted 50%. In contrast, student B had



	STUDENT A	STUDENT B
AVERAGE HW SCORES:	92	92
TEST #1:	71	90
TEST #2:	77	86
FINAL EXAM:	88	68
WEIGHTED SCORE:	92(.2)+74(.3) +88(.5) = 84.6	92(.2)+88(.5) +68(.3) = 82.8

Figure 1

Notation

N	Counter (counts number of students)	
N1	Number of homework assignments	(INPUT)
P1(I)	Point value of Ith homework assignment	(INPUT)
T1	Total point value of all homework assignments	
G1(I)	Student grade on Ith homework assignment	(INPUT)
S1	Sum of all student homework assignment grades	
W1	Weight given to homework assignments	(INPUT)
N2	Number of in-term tests	(INPUT)
P2(I)	Point value of Ith in-term test	(INPUT)
T2	Total point value of all in-term tests	
G2(I)	Student grade on Ith in-term test	(INPUT)
S2	Sum of all student in-term test grades	
F2	Weight given to in-term tests	(INPUT)
P3	Point value of final examination	(INPUT)
G3	Grade student earned on final examination	(INPUT)
N$	Student name	(INPUT)
Q$	Response (Yes or No) to query: "ANOTHER STUDENT?"	(INPUT)
S	Average weighted score of all students	
P	Print device (Missing or ‡2 for printer)	
I	FOR-NEXT loop index	

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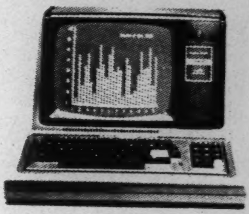

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CIRCLE 163 ON READER SERVICE CARD

Grading, cont'd...

his final exam grade weighted 30% since it was lower than the average (=88) of his two test scores. Without this boost, student B would have had a weighted score in the 70's. You have the opportunity, of course, to enter any weights into the accompanying computer program that suit your purposes.

So far it would seem that the computer doesn't do much computation – that you could easily do this by hand. But there is more. It is not at all necessary that each test be based on the usual 100 points. If you decide on 8 problems for a test, why not have 80 as the perfect score? Going one step further, a perfect score on the last final exam I gave was 108 points. Why 108?? The explanation is easy. The final was based on nine problems. Some of these problems contained one part, some problems contained two parts, others had three parts and still others had four. It was natural to base each problem on twelve points since one, two, three and four each divide evenly into twelve. Thus, if you desire to give equal credit to each part in any one problem, all you need to do is divide 12 by the number of parts. Each part, for example, of a three-part problem was worth four points — a nice round number — and easy to grade too. Finally, 9 problems times 12 points for each problem = 108 points.

If you decide on 8 problems for a test, why not have 80 as the perfect score?

Reasonable?

The attached computer program thus requires, and indeed asks for, the number of points for a perfect score for each test as one of the initial inputs. In a similar vein, homework grades could also be geared to the number of problems given in each assignment, four problems for one assignment, nine problems for the next, etc. When you first use the computer program at the end of the semester, enter the 'perfect score' for each homework assignment as well. Once done, you are now ready to turn your attention to the students. You enter each student's name and all corresponding scores.

As a permanent record (if you or your school computer has a printer), the program prints each student's name on the raw scores you entered — this provides a valuable check on your inputs — and all corresponding grades expressed in percent. In addition the average score for each element is shown and finally, of course, you obtain the 'weighted score.' The end of the run concludes with the average of all 'weighted scores.'

PROGRAM LISTING

```
10 N=0
20 DIM N$(20)
30 PRINT"FIXED INPUTS FOLLOW:"
40 INPUT"ENTER WEIGHT YOU WISH TO GIVE TO HOMEWORK IN DECIMAL FORM ",W1
50 INPUT"ENTER HIGHER OF REMAINING TWO WEIGHTS IN DECIMAL FORM ",W3
60 W2=1-W1-W3
70 PRINT"LOWER OF REMAINING TWO WEIGHTS IS ",W2
80 INPUT"NUMBER OF HW ASSIGNMENTS ? ",N1
90 FOR I=1 TO N1
100 PRINT"ENTER POINT VALUE OF HW ASSIGNMENT #",I,
110 INPUT"     ",P1(I)
120 T1=T1+P1(I)
130 NEXT I
140 INPUT"NUMBER OF IN-TERM TESTS ? ",N2
150 FOR I=1 TO N2
160 PRINT"ENTER POINT VALUE OF IN-TERM TEST #",I,
170 INPUT"     ",P2(I)
180 T2=T2+P2(I)
190 NEXT I
200 INPUT"ENTER POINT VALUE OF FINAL EXAMINATION     ",P3
210 S1=0
220 S2=0
230 T=0
240 PRINT#P
250 PRINT"STUDENT INPUTS FOLLOW"
260 PRINT
270 INPUT"STUDENT NAME ? ",N$
280 FOR I=1 TO N1
290 PRINT"ENTER GRADE EARNED ON HW ASSIGNMENT #",I,
300 INPUT"     ",G1(I)
310 NEXT I
320 FOR I=1 TO N2
330 PRINT"ENTER GRADE EARNED ON IN-TERM TEST #",I,
340 INPUT"     ",G2(I)
350 NEXT I
360 INPUT"ENTER GRADE EARNED ON THE FINAL EXAMINATION     ",G3
370 PRINT#P
380 PRINT#P,N$
390 PRINT#P"HW RAW SCORES: ",
400 FOR I=1 TO N1
410 S1=S1+G1(I)
420 PRINT#P,G1(I),
430  NEXT I
440 PRINT#P
450 PRINT#P"HW GRADES IN %: ",
460 FOR I=1 TO N1
470 PRINT#P,INT(G1(I)*100/P1(I)),
480 NEXT I
490 PRINT#P
500 PRINT#P"AVERAGE HW GRADE: ",INT(S1*100/T1)
510 PRINT#P"IN-TERM TESTS RAW SCORES: ",
520 FOR I=1 TO N2
530 PRINT#P,G2(I),
540 S2=S2+G2(I)
550 NEXT I
560 PRINT#P
570 PRINT#P"IN-TERM TESTS IN %: ",
580 FOR I=1 TO N2
590 PRINT#P,INT(G2(I)*100/P2(I)),
600 NEXT I
610 PRINT#P
620 PRINT#P"AVERAGE IN-TERM TEST GRADE: ",INT(S2*100/T2)
630 PRINT#P,"FINAL EXAMINATION RAW GRADE SCORE IS ",G3
640 PRINT#P,"FINAL EXAMINATION SCORE IN PERCENT IS ",INT(G3*100/P3)
650 IF S2/T2 . G3/P3 THEN F3=W2 ELSE F3= W3
660 F2=1-W1-F3
670 T=W1*S1/T1+F2*S2/T2+F3*G3/P3
680 PRINT#P"AVERAGE WEIGHTED TERM GRADE SCORE IS ",INT(T*100)
690 S=S+T
700 INPUT"ANOTHER STUDENT ?    (YES OR NO)   ",Q$
710 N=N+1
720 IF Q$(1,1)="Y" THEN 210 ELSE 730
730 PRINT#P
740 PRINT#P"AVERAGE WEIGHTED SCORE OF ALL STUDENTS IS ",S*100/N
```

The computer program, written in North Star Basic, implements this grading scheme in a very straightforward manner. In fact, it is easy to follow the program simply by looking at all the print statements which detail the inputs and the computations. For completeness, definitions for all the variables are also provided.

The sample run considers two hypothetical students who have done reasonably well. All inputs to the program are by query, which is easily identified by a question mark or the direct prompt ENTER. If you use a printer, only the ten summary lines headed by the student's name will appear on the paper.

Next time you have to submit those final grades, sit back, relax and let the computer do most of the work for you!□

SAMPLE RUN

```
RUN

FIXED INPUTS FOLLOW:
ENTER WEIGHT YOU WISH TO GIVE TO HOMEWORK IN DECIMAL FORM .2
ENTER HIGHER OF REMAINING TWO WEIGHTS IN DECIMAL FORM .5
LOWER OF REMAINING TWO WEIGHTS IS  .3
NUMBER OF HW ASSIGNMENTS ? 5
ENTER POINT VALUE OF HW ASSIGNMENT # 1     50
ENTER POINT VALUE OF HW ASSIGNMENT # 2     70
ENTER POINT VALUE OF HW ASSIGNMENT # 3     60
ENTER POINT VALUE OF HW ASSIGNMENT # 4     50
ENTER POINT VALUE OF HW ASSIGNMENT # 5     90
NUMBER OF IN-TERM TESTS ? 2
ENTER POINT VALUE OF IN-TERM TEST # 1    80
ENTER POINT VALUE OF IN-TERM TEST # 2    90
ENTER POINT VALUE OF FINAL EXAMINATION    108

STUDENT INPUTS FOLLOW

STUDENT NAME ? ANDERSON
ENTER GRADE EARNED ON HW ASSIGNMENT # 1     45
ENTER GRADE EARNED ON HW ASSIGNMENT # 2     62
ENTER GRADE EARNED ON HW ASSIGNMENT # 3     58
ENTER GRADE EARNED ON HW ASSIGNMENT # 4     50
ENTER GRADE EARNED ON HW ASSIGNMENT # 5     77
ENTER GRADE EARNED ON IN-TERM TEST # 1    62
ENTER GRADE EARNED ON IN-TERM TEST # 2    73
ENTER GRADE EARNED ON THE FINAL EXAMINATION    102

ANDERSON
HW RAW SCORES:  45 62 58 50 77
HW GRADES IN %:  90 88 96 100 85
AVERAGE HW GRADE:  91
IN-TERM TESTS RAW SCORES:  62 73
IN-TERM TESTS IN %:  77 81
AVERAGE IN-TERM TEST GRADE:  79
FINAL EXAMINATION RAW GRADE SCORE IS  102
FINAL EXAMINATION SCORE IN PERCENT IS  94
AVERAGE WEIGHTED TERM GRADE SCORE IS  89
ANOTHER STUDENT ?    (YES OR NO)      Y
```

```
STUDENT INPUTS FOLLOW

STUDENT NAME ? HARRISON
ENTER GRADE EARNED ON HW ASSIGNMENT # 1     50
ENTER GRADE EARNED ON HW ASSIGNMENT # 2     70
ENTER GRADE EARNED ON HW ASSIGNMENT # 3     55
ENTER GRADE EARNED ON HW ASSIGNMENT # 4     38
ENTER GRADE EARNED ON HW ASSIGNMENT # 5     90
ENTER GRADE EARNED ON IN-TERM TEST # 1    72
ENTER GRADE EARNED ON IN-TERM TEST # 2    89
ENTER GRADE EARNED ON THE FINAL EXAMINATION    73

HARRISON
HW RAW SCORES:  50 70 55 38 90
HW GRADES IN %:  100 100 91 76 100
AVERAGE HW GRADE:  94
IN-TERM TESTS RAW SCORES:  72 89
IN-TERM TESTS IN %:   90 98
AVERAGE IN-TERM TEST GRADE:  94
FINAL EXAMINATION RAW GRADE SCORE IS  73
FINAL EXAMINATION SCORE IN PERCENT IS  67
AVERAGE WEIGHTED TERM GRADE SCORE IS   86
ANOTHER STUDENT ?    (YES OR NO)   N

AVERAGE WEIGHTED SCORE OF ALL STUDENTS IS   87.931985
READY
```

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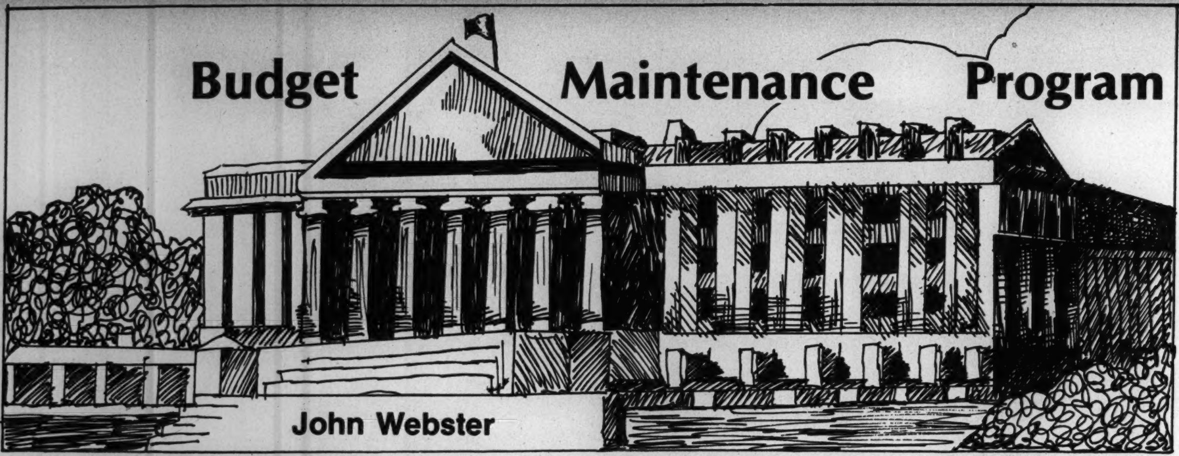
CIRCLE 189 ON READER SERVICE CARD

Budget Maintenance Program



John Webster

A useful program for managing a department budget presented with introductory material on using North Star disk files.

If you are a manager or department head in an institution, school, university, private corporation, or government organization, then the preparation and administration of a budget is one of your daily concerns. If you wish to utilize your microcomputer to assist you, you may find that there is no really applicable software available. On one hand, computerized accounting programs are certainly available. The problem with these, however, is that they tend to include such arcane concepts as ledgers, double entries, etc., that are more the province of the accountants in your business office. And there is no point in simply duplicating their activities on a smaller scale. On the other hand, the simple checkbook balancing programs designed for domestic use do not include enough detail or flexibility to be very helpful.

As a bridge between these two extremes, the following Budget Maintenance Program is suggested. It assumes that your institution has a centralized business office that does the 'real' accounting and bookkeeping, and so does not try to needlessly duplicate these efforts. It does, however, use the microcomputer's ability to cross-index information and to add up columns of figures in a hurry, to provide you with very useful day-to-day information on the state of your budget. Such questions as: Is revenue in a certain area meeting projections? Has P.O. #xxxxxx been received? Do we have enough money in the supplies account to buy extra materials before the price goes up? Who did we order crenelated gizmos from last October, and how much were they? The BMP will provide answers to these and virtually any other related questions you can think of very rapidly (such as in the middle of a telephone query or staff meeting).

Utilization of the BMP will also greatly simplify your annual budget preparation ordeal. Whether your budget is historically or zero-base determined, the data accumulated over the previous year will show very clearly how much each division in your department costs to provide its various services.

Finally, the BMP is extremely flexible. By understanding the structure of the records in the data file, you can easily add your own menu options to those presented here.

The purpose of this article then, is two-fold. First it presents an implementation of the program just described (in North Star Basic) and, secondly, it gives some insight into using North Star disk files: How they may be accessed and utilized.

Structure of the Program

The main program, BUDGET, contains a menu as well as the functions necessary to enter new records into the file and to modify existing records. All other menu options are separate, stand-alone programs CHAINed to BUDGET. The disk also contains a data file, ACCT, which holds all the transaction records. A short program, ANEW, is used to initialize the ACCT data file the first time it is used. Before examining the programs in more detail, let's look at some basic information on North Star disk files.

File Structure

Data files on North Star disks are any number (up to the capacity of the disk) of sequential bytes of information. Each file has a name (e.g., ACCT) and ends with an endmark. One file contains a number of records and each record is made up of a number of fields. Each field is a specific number of bytes. If we compare a computer disk file to a manual filing system, the file would be analogous to the filing folder. Each record might be a page of paper in the folder and each field a word, number or sentence on the page.

In designing a computer data file the first thing to be concerned with is the structure of the records. All similar records will be the same length and must allow space for all the information you might want that record to contain. Say, for example, you start building a file of records, each of which contains a purchase order number and an account code. If you were to decide in six months time that you also wanted to know the date of a specific transaction, then you're in trouble. Adequate space must be provided when the record structure is first set up. As records are stored sequentially on the file, there would be no room for date information on your first six months worth of entries. Table 1 lists the various fields which make up one transaction record in the Budget Maintenance Program.

TABLE 1

Label	Description	Number of Bytes	Type of Variable
M	Record No. of this transaction	5	Numeric
A	Object Code (account)	5	Numeric
A$(8)	Date (mm/dd/yy)	10	String
D$(1)	Division Dimension (of the Department)	3	String
C$(30)	Description/Name	32	String
R	Revenue amount	5	Numeric
C	Chargeback amount	5	Numeric
E	Expenditure amount	5	Numeric
B$(8)	P.O./Receipt #	10	String
S$(8)	Supplier/ Description	10	String
R$(1)	Status (O, R, C)	3	String
		TOTAL = 93 Bytes per record	

John Webster, Director, Audio Visual Services, University of New Brunswick, Fredericton, NB, CANADA.

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CIRCLE 167 ON READER SERVICE CARD

Budget, cont'd . . .

Eventually we will have to know how many bytes of disk space each of our records will require, so let's use the BMP records as an example and figure it out now. There are two rules to remember:

1. A numeric variable (regardless of its size) will take five bytes of disk space;

2. A string variable will take one byte for each character in the string (not its dimensioned size!) plus two (if the string is less than 256 characters long) or three (if it is more than 256).

These rules are very important to understand. If we say A$ = "George" then we would require 6 + 2 bytes of disk space to store A$, whether A$ was dimensioned to 6 or 60. Similariy, if A$ = "Bill" then A$ would store in 4 + 2 bytes.

The simple checkbook balancing programs designed for domestic use do not include enough detail or flexibility.

If you will be reading data files by random access (as we will in these programs),often it is necessary to have A$ store in the same length space regardless of what it contains. This will allow you to skip A$, for example, if you want to access the next field or to skip an entire record of fields to reach the next one. (Remember that numeric variables are no problem. They always use five bytes). If we look at our 'description' field (see Table 1) we have decided that we will allow for a 30-character description. It might be less than 30 characters but it can't be more. Therefore, we will call our description field C$ and dimension it to thirty: C$(30). We will also dimension another string of blanks to thirty: L$(30). Then when C$ is input from the keyboard L$ is concatenated with C$:

```
INPUT C$
C$ = C$ + L$
```

This has the effect of filling C$ with blanks after the input value, if the input value has less than thirty characters, to ensure that C$ contains exactly thirty characters. We can now be sure that every description field contains exactly thirty characters (whether it is George # 24 blanks or Bill # 26 blanks or Consolidated Aircraft + 9 blanks). See Table 1 for byte allocations in each BMP transaction record.

The Header

Our data file also contains something called a header which uses the first 250 bytes of the file. All transaction records are then stored sequentially after the header.

All fields in the header are numeric variables. Our budget is broken down into 16 different accounts (or object codes). For example, 121 is external revenue, 601 is a supplies account, 762 is capital equipment and so on. The bulk of the header consists of 3-field records containing object code number, original balance and the present balance. Whenever a new record (transaction) is entered, the present balance of the pertinent object code is modified. This allows quick access to the balances in all accounts (as in the DISP Program). The last field in the header is the record number of the last transaction currently in the file (N) and the first field is the record number of the first record in the file (N5). These values are used by the programs to compute the total number of records in the file (N-N5+1), the next valid record number to be used (N+1), etc. This system also allows you to use as many disks as you need to store your transactions.

Finally, we can see that our data file will require 250 bytes of disk space for the header, plus 93 bytes for each record. Single density North Star disks store 256 bytes per sector (or block). Thus, a data file one hundred blocks long would store the header and 272 transaction records.

Accessing Data Files

There are two methods of reading and writing to disk data files; sequential and random access.

Before accessing a data file by either method, the file must be opened:

```
OPEN #0, "ACCT"
```

It gives some insight into using North Star disk files.

A WRITE statement will then cause data to be entered into the file (starting at the beginning of the file) and an endmark will be written after the last entry:

WRITE #0, A, B, C (this would be record #1) A subsequent WRITE statement:

WRITE #0, A, B, C (this would be record #2) will cause a second record to be appended to the first. The original endmark is written over and a new endmark is placed at the end of the second record. This is sequential file access. So long as the file remains open, the file pointer is moved along in the file by the WRITE statements. When file access is complete, the file should be closed:

```
CLOSE #0
```

The zero (0) in the above examples is a file number, assigned to that file when it is OPENed and used to differentiate it from other files that may be open at the same time.

READ statements function in the same way:

```
OPEN #0, "ACCT"
READ #0, A, B, C
```

will cause the variables A, B and C to be loaded with the values in the first record. A subsequent READ statement will read the second record, etc.

If we compare a computer disk file to a manual filing system, the file would be analogous to the filing folder.

It is necessary to realize here that information must be read from a record in the same sequence it was written. This is especially important if one record contains a mixture of numeric and string variables, e.g., A, B$, C. A READ statement to access this data must contain first a numeric variable, then a string variable and finally another numeric. Attempting to access this data example with the following statement: READ #0, A, B, C, will return a TYPE (more about TYPE later) error. A correct READ statement might be: READ #0, X, Y$, Z.

Note the use of loops to cause these sequential WRITEs and READs in the ANEW and DISP programs.

Random access simply allows you to skip a specified number of bytes (from the beginning of the file, not from the last position of the file pointer) before performing a READ or WRITE:

```
OPEN #0, "ACCT"
READ #0 %(expression), A, B, C
```

In the case of the BMP, for example, it is necessary to skip over the header before reading the first transaction record:

```
OPEN #0, "ACCT"
READ #0, %250, M, A, A$, D$, C$, R, C, E, B$, S$, R$.
```

If we only wanted to know the date of the first transaction we could: Read #0 %260, A$.

It should now be clearer why we were concerned with making all string variables store in a predictable number of bytes. It now becomes a simple matter to random access the nth record in the file by skipping n-1 records. Since we know that each record in a file contains 93 bytes and our header contains 250 bytes, the following statement will let us READ the nth record:

```
READ #0%93*(n-1)+250, M, A, A$
    . . . etc.
```

What if we want to modify something in the nth record? The theory is exactly the same as reading a value in the nth record,only we use a WRITE statement.

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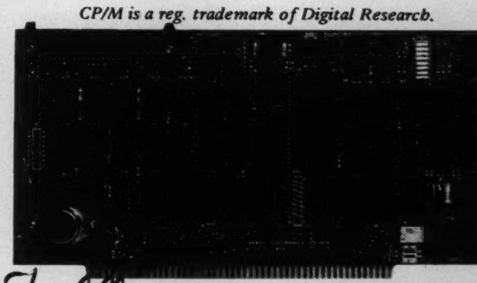

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CIRCLE 202 ON READER SERVICE CARD

Budget, cont'd . . .

Before we do this, however, remember that we said a WRITE statement will enter an endmark after the last value written. This is obviously desirable in this case,as it would leave an endmark in the middle of our nth record. Therefore, we terminate our WRITE statement with NOENDMARK. For example, let's say we want to replace the date information in the nth record with a new value, B$. The proper statement would be as follows:

```
WRITE#0%93*(n-1)+260,
    B$,NOENDMARK.
```

We mentioned earlier that trying to read string data into a numeric variable (or vice versa) would result in a type error. North Star Basic contains a TYP function that will tell you the type of the next variable to be read.

The TYP(file number) function will return a value of zero (0) if the next field is an endmark, a one (1) if the next field is string variable, and a two (2) if the next field is a numeric variable.

One useful application of the TYP function is to find the end of a data file by sequential access:

Be sure that every description field contains exactly thirty characters.

If TYP(0) = 0 THEN (this is the end, we can add a new record) ELSE (read another record).

The North Star Basic manual gives a program example that uses the TYP function in conditional IF statements to control which kind of variable is read next. This allows the reading of a data file of unknown structure.

Finally, two common error messages that will be encountered in using the data files are TYPE error and FILE error.

A TYPE error may mean:

- you made a mistake in calculating your random-access offset (the expression after the %) and are trying to read the wrong type of variable.
- you inadvertently added an endmark in the middle of your data file during some previous WRITE access and your file is no longer as long as you thought it was.

A FILE error may mean:

- you are trying to OPEN (or CLOSE) a file that is already open (or closed)
- you are trying to write to a protected disk (forgot to take the protect tab off).

The BUDGET Program

The BUDGET program begins by displaying a "menu" of options. Option numbers 1 and 3 are in the BUDGET program itself, all others (and ones you will add), CHAIN to separate programs. Notice that the ANEW program is not accessible through the menu,as it is only used to initialize a new data file and would destroy an existing data file if inadvertently run.

Line 540 of the BUDGET program will determine the number of records that will fit into the size of file you have initialized (250 bytes for header, 100 for tail = 350). Line 570 may be used if you wish to limit the number of records to less than the maximum (say, 600 records per file to make it work out evenly). If you don't care about easy numbers and want to fill your initialized ACCT file then delete 570.

When the program determines that your data file is full, the header values (C=present balance) are copied into a 'tail' which is written directly after the last record in the file. The purpose of the 'tail' is to function as a temporary variable set by which to judge whether the header of that disk has been modified or not. After the subsequent disk is updated, the 'tail' is corrected to equal the modified header value.

DISP

DISP accesses data from the header fields and displays the present balances along with account number, description and original approved balance for each account. This is a very fast program and is very handy for seeing what you have in any given account at any time. You will modify the data statements (line 210 to 240) to contain appropriate descriptions of your various accounts. If you have a printer, it may be useful to generate DISP printouts at the end of each month to keep a record of activities over the year.

Information must be read from a record in the same sequence it was written.

Notice that DISP uses both random and sequential access. Line 100 is a random access READ statement with an offset value of zero which returns the file pointer to the beginning of the file, and then redundantly reads N5 to set the file pointer to the second field. Object codes and amounts are then read from the header using sequential access in the FOR loop (line 110). Another method of resetting the pointer would be to CLOSE and immediately OPEN the file before READing N5.

DIVDIS and DIVDIS 2

These programs take a bit longer to run as they access all file records. Their purpose is to give a complete expense picture incorporating all transactions pertaining to any one area (division) of the department for a chosen time period.

DIVDIS requires only one disk drive and some programmable memory starting at location zero to store the pertinent record numbers. Its only limitation is that all your records must fit into one single ACCT data file.

DIVDIS 2 will gather data from multiple ACCT files but requires a buffer ACCT file on a second drive. DIVDIS 2 first transfers all records with division and data fields matching the parameters selected into the buffer file to prepare an expense statement similar to DIVDIS. There is no need for

DIVDIS 2 to store pertinent record numbers in programmable memory as they are kept in the buffer file. DIVDIS uses the stored record numbers to access the proper records if you wish details of the transaction.

The sample runs show slight differences in the printout for the two programs merely to show two different approaches. Either display format could be used with either program or you may alter the display further to suit your needs. Line 580 in DIVDIS prints a space when the hundreds digit of the account code increments. This groups similar accounts (e.g., 600's are all supplies) in the display. Inactive object codes are ignored by the display.

As date information is entered MM/DD/YY, a VAL function of the date character string will return a number corresponding to the month.

Certainly the inclusion of more sophisticated data base handling techniques (such as 'hashing,' which uses pointers to link pertinent records in a file) could be applied to either of these two programs to increase their speed. This would, of course, lengthen the program and data records. In defense of the "brute force" approach presented here, it was written by a novice to meet a specific need (which it does). It is hoped that the simple approach will be more understandable and provide a model which can be modified and improved upon.

CANT

Occasionally it is necessary to cancel a transaction. The CANT program finds the transaction you wish to cancel, displays the details and after asking you again to make sure you really want to cancel it, changes the record's status to "C" which will prevent it from being modified in the future. It then modifies the header record to remove the effect of the transaction's value (either income or expenditure) from the pertinent object code balance.

As the record is not removed from the file, all pertinent details of the transaction are saved for reference.

POS and SSRCH

POS allows you to search your data file by Purchase Order Number (to see if it has been received, the price, or whatever). Super Search is an extension of the same techniques and allows you to search your data file for any possible combination of parameters. POS is smaller and faster to use if you are checking the status, say, of a list of P.O. numbers. Super Search, on the other hand, will allow you to find out if your equipment division purchased anything from Consolidated Whatsits during the month of March. Super Search prompts the user (lines 60 and 230) asking for specific parameters (object codes, month, division, etc.). The user may enter a value or simply press Return. If a value is entered, the program will use it as one of the parameters it tries to match. If no value is entered, then the content of that particular field will not be examined for a match. For example: If you enter a '1' in response to the prompt 'month (1-12)': (line 80), the program will consider only transactions for the month of January. If you do not enter a value and merely press 'return,' all months will be considered.

The user also has the option of searching for an exact 'supplier' name or specifying only the first letter. This is useful if you are not sure of the exact abbreviations used when the supplier name was entered.

By concatenating the input string (A2$, in this case) with a string variable (L$) filled with blanks, as described earlier, the computer will accept a 'return' as a valid input and ignore that parameter in its search for matching data (e.g., line 340).

UPDATE

Option #7 in the menu is an updating program to correct the header balances on a disk in the event that a value of a record on a previous disk is modified. This program is only used if you have two drives and are using several disks to hold all your ACCT files. The UPDATE program issues instructions and will not allow you to erroneously update the wrong disks.

The ANEW program is not accessible through the menu as it is only used to initialize a new data file.

Say, for example, you are presently on your third ACCT file and you find that an invoice amount in a record on your first disk must be modified. First, the amount in the record on the first disk is modified using menu option #2. Then run UPDATE with disk #1 in drive #1 and disk #2 in drive #2. Finally, run UPDATE again with disk #2 in drive #1 and disk #3 in drive #2. This will correct your present header balances and insure that your output from the DISP program is correct.

Adding Additional ACCT Files

Once you have the BUDGET program and any others you wish to use stored on a disk (along with DOS and Basic), use DOS to create a type 3 file called ACCT. Then run your customized version of ANEW (probably kept on another disk to save space and prevent inadvertent use). Make the ACCT file as large as possible, especially if you have only one disk drive.

If your volume of transactions exceeds the capacity of one ACCT file, you will periodically have to add new ones. The BUDGET program keeps track of how many empty records you have left in your current ACCT file and displays this information whenever you add a new record to the file (lines 540 through 590). The procedure for initializing additional ACCT files is as follows:

It may be useful to generate DISP printouts at the end of each month to keep a record of activities over the year.

When the BUDGET program determines that the ACCT file is full, it will indicate this and write a 'tail' (containing all the present balances from the header) immediately following the last record.

Place a new disk into drive #2 and copy your previous disk (go to DOS, CD 1 2). Then run UPDATE (option #7). This will update N5 on the second disk (N5(2) = N(1) + 1). You are now ready to place the newly initialized second disk into drive #1 and begin entering additional records.

Conclusion

Notice that considerable program space has been devoted to "error checking" input responses. Although there is no way to completely check the validity of data entered, the program will generally reject inappropriate responses and provides the user with a display of the values entered before they are written to the file.

Remember it is wise to keep a regularly updated back copy of your current ACCT file. A few minutes copying work every day or so will save days of retyping in the event of some catastrophic system or disk failure. With a basic understanding of random disk file access you can readily begin to make your micro "do something useful."

NOTE: A single density North Star disk containing all the Budget Maintenance Programs described in the article is available from the author for $25.00.

System Requirements:

North Star Basic and DOS
20K RAM
1 or 2 disk drives

```
READY
LIST
10 REM BUDGET MAINTENANCE PROGRAMS
20 REM COPYRIGHT 1979 BY JOHN WEBSTER
30 REM A V SERVICES, UNIVERSITY OF NEW BRUNSWICK
40 REM FREDERICTON, N.B., CANADA
50 DIMA$(8),D$(1),C$(30),I$(1),L1$(8),L2$(30),B$(8),S$(8),
   R$(1),L$(1),Y$(8),V$(11),C2$(30)
60 DIMC(16)
70 REM 20 - 190 MENU ROUTING
80 REM EXPAND TO ADD OPTIONS
90 !\!\!\!\!"BUDGET MAINTENANCE PROGRAM"
100 !\!"   UNB AV SERVICES    "
110 !\!
120 !"              MENU"
130 !
140 !"1.  ADD RECORDS TO FILE"
150 !"2.  SUPER-SEARCH "
160 !"3.  MODIFY AN EXISTING RECORD"
170 !"4.  DISPLAY PRESENT BALANCES"
180 !"5.  DISPLAY BALANCES BY DIVISION"
190 !"6.  CANCEL A TRANSACTION"
200 !"7.  UPDATE DISC FILES"
210 !\!\!\!
220 INPUT "CHOOSE ONE: ",I
230 !\!\!\!
240 IF I>7 THEN 220
250 IF I=0 THEN 110
260 ON I GOTO 470,2220,280,2230,2240,2250,2255
270 REM 200 - 360 SET UP FOR MODIFY
280 OPEN#0, "ACCT"
290 READ#0,N5
300 READ#0 %245,N
310 CLOSE#0
320 !\!"THIS FILE CONTAINS TRANSACTIONS ",N5," THROUGH ",N
330 !\INPUT"WHICH NUMBER WOULD YOU LIKE TO MODIFY? : ",M
340 IF M=0 THEN 110
350 IF M>N THEN 320
360 IF M<N5 THEN 320
370 R2=0\C2=0\E2=0
380 OPEN#0, "ACCT"
390 READ#0 %250+(93*(M-N5))+5,A2,A2$,D2$,C2$,R2,C2,E2,B2$,S2$,R2$
400 CLOSE#0
410 IF R2$="C" THEN 420 ELSE 760
420 !"P.O./RECEIPT# ",B2$," HAS BEEN CANCELLED AND MAY NOT BE
430 !\!\!\!\INPUT"PRESS RETURN TO CONTINUE....",W$      MODIFIED."
440 GOTO 110
450 REM GET READY TO ADD RECORDS
460 REM S5 = SIZE OF FILE (BLOCKS)
470 OPEN#0, "ACCT",S5
480 READ#0,N5
490 READ#0 %245,N
500 CLOSE#0
510 REM IF M=N+1 WE ARE ADDING A RECORD
520 REM IF M<N+1 WE ARE MODIFYING EXISTING RECORD
530 M = N+1
540 REM S5=#OF RECORDS AVAILABLE
550 S5=INT((S5*256-350)/93)
560 REM USE 570 TO LIMIT FILE LENGTH ELSE USE 580
570 IF N-N5>=599 THEN 600
580 IF S5+(N5-1)=N THEN 600
590 !"THERE ARE ",S5+(N5-1)-N," EMPTY RECORDS REMAINING."\GOTO 760
600 OPEN#0,"ACCT"
610 !"DATA FILE FULL!"
620 READ#0%250+93*(N-N5+1)-3,R$
630 IF TYP(0)=0 THEN 650
640 CLOSE#0\GOTO120
650 FOR I=0 TO 15
660 READ#0%(15*I)+5,A,B,C(I+1)
670 NEXT
680 FOR I=0 TO 15
690 WRITE#0%250+93*(N-N5+1)+(5*I),C(I+1)
700 NEXT
710 CLOSE#0
720 !"DATA FILE IS FULL. COPY DISC THEN LOAD AND RUN  UPDATE'"
730 !"ENTER 'BYE' TO RETURN TO DOS"
740 END
750 REM INPUT ROUTINE FOR ADD AND MODIFY STARTS HERE
760 !\!\!"RECORD NO.: ",M\!
770 REM CUSTOM ERROR MESSAGE
780 ERRSET 2270,Q,Q1
790 !"OBJECT CODE: ",
800 IF M<N+1 THEN !"( WAS:",A2," ) ",
810 INPUT ": ",Y$\!
820 Y$=Y$+L2$
830 IF Y$(1,1)=" " THEN IF M<N+1 THEN A=A2 ELSE 110 ELSE A=VAL(Y$)
840 IF A=0 THEN 110
850 !"DATE (MM/DD/YY): ",
860 IF M<N+1 THEN !"( WAS:",A2$," )",
870 INPUT ": ",A$\A$=A$+L2$
880 IF A$(1,1)=" " THEN IF M<N+1 THEN A$=A2$+L2$ ELSE 850
890 !\PRINT "DIVISION (G,M,F,W,E,P): ",
900 IF M<N+1 THEN !"( WAS:",D2$," )",
910 INPUT ": ",D$\D$=D$+L2$
920 IF D$=" " THEN IF M<N+1 THEN D$=D2$ ELSE 890
930 REM T FLAG CHECKS FOR INPUT ERRORS
940 IF D$="G" THEN T=1
950 IF D$="M" THEN T=1
960 IF D$="F" THEN T=1
970 IF D$="W" THEN T=1
980 IF D$="E" THEN T=1
990 IF D$="P" THEN T=1
1000 IF T=0 THEN 890
1010 T=0
1020 !\PRINT "AMOUNT: ",
1030 IF R2<>0 THEN D2=R2
1040 IF C2<>0 THEN D2=C2
1050 IF E2<>0 THEN D2=E2
1060 IF M<N+1 THEN! "( WAS: ",%$C12F2,D2," )",
1070 INPUT ": ",Y$\Y$=Y$+L2$
1080 IF Y$(1,1)=" " THEN IF M<N+1 THEN D=D2 ELSE 1020 ELSE D=VAL(Y$)
1090 R=0\C=0\E=0
1100 !\!"IS THIS AMOUNT REVENUE,CHARGEBACK OR EXPENDITURE?"
1110 IF R2<>0 THEN V$="REVENUE"
1120 IF C2<>0 THEN V$="CHARGEBACK"
1130 IF E2<>0 THEN V$="EXPENDITURE"
1140 IF M<N+1 THEN !"( WAS: ",V$," )"
1150 INPUT "CHOOSE ONE (R,C,E): ",I$\I$=I$+L2$
1160 IF I$(1,1)=" " THEN IF M<N+1 THEN I$=V$(1,1) ELSE 1150
1170 IF I$="R" THEN R=D ELSE 1190
1180 GOTO 1220
1190 IF I$="C" THEN C=D ELSE 1210
1200 GOTO 1220
1210 IF I$="E" THEN E=D ELSE 1150
1220 IF I$="E" THEN 1280
1230 !\!"RECEIPT/INVOICE #: ",
1240 IF M<N+1 THEN !"( WAS: ",B2$," )",
1250 INPUT ": ",B$\B$=B$+L2$
1260 IF B$(1,1)=" " THEN IF M<N+1 THEN B$=B2$+L2$ ELSE 1230
1270 GOTO 1320
1280 !\!"P.O.#: ",
1290 IF M<N+1 THEN !"( WAS: ",B2$," )",
1300 INPUT ": ",B$\B$=B$+L2$
1310 IF B$(1,1)=" " THEN IF M<N+1 THEN B$=B2$+L2$ ELSE 1280
1320 !\IF M=N+1 THEN !TAB(15),"------------------------------"
1330 IF I$="E" THEN 1400
1340 PRINT "      NAME: ",
1350 IF M<N+1 THEN !"( WAS: ",C2$," )"
1360 IF M<N+1 THEN !"  ------------------------------"
1370 INPUT " : ",C$\C$=C$+L2$
1380 IF C$(1,1)=" " THEN IF M<N+1 THEN C$=C2$+L2$ ELSE 1320
1390 GOTO 1450
1400 !\!"DESCRIPTION: ",
1410 IF M<N+1 THEN !"( WAS: ",C2$," )"
1420 IF M<N+1 THEN !"  ------------------------------"
1430 INPUT ": ",C$\C$=C$+L2$
1440 IF C$(1,1)=" " THEN IF M<N+1 THEN C$=C2$+L2$ ELSE 1320
1450 !\IF M=N+1 THEN !TAB(16),"--------"
1460 !\IF M<N+1 THEN !TAB(32),"--------"
1470 IF I$="E" THEN 1530
1480 PRINT "DESCRIPTION: ",
1490 IF M<N+1 THEN !"( WAS: ",S2$," )",
1500 INPUT ": ",S$\S$=S$+L2$
1510 IF S$(1,1)=" " THEN IF M<N+1 THEN S$=S2$+L2$ ELSE 1450 ELSE 1570
1520 GOTO 1570
1530 PRINT "   SUPPLIER: ",
1540 IF M<N+1 THEN !"( WAS: ",S2$," )",
1550 INPUT ": ",S$\S$=S$+L2$
1560 IF S$(1,1)=" " THEN IF M<N+1 THEN S$=S2$+L2$ ELSE 1530
1570 !\!"STATUS: O = ON ORDER (OR OUT FOR SIGNATURE)"
1580 !"         R = RECEIVED (COMPLETE)"
1590 PRINT "ENTER STATUS (O/R): ",
1600 IF M<N+1 THEN !"( WAS: ",R2$," )"
1610 INPUT ": ",R$\R$=R$+L2$
1620 IF R$=" " THEN IF M<N+1 THEN R$=R2$+L2$ ELSE 1590
1630 IF R$="O" THEN 1660
1640 IF R$="R" THEN 1660
1650 GOTO 1590
1660 !\!\!\!\!\!
1670 REM DOUBLE CHECK ENTRIES BEFORE WRITING TO DISC
1680 !\!\!\!\!\!
1690 !"REC.NO.: ",M,"   OBJ.CODE: ",A,"   DATE: ",A$\!
1700 !"DIVISION: ",D$,"   AMOUNT: ",%$C11F2,D,"   TYPE: ",I$\!
1710 !"P.O./RECEIPT/INVOICE#: ",B$,"   NAME/DESCR.: ",C$\!
1720 !"DESCR./SUPPLIER: ",S$,"   STATUS: ",R$\!
1730 !\!\INPUT "ARE THESE ENTRIES CORRECT? (Y/N): ",X$
1740 REM SEE LINES 1900 TO 1990
1750 IF X$="Y" THEN 1780
1760 IF X$="N" THEN 1780
1770 GOTO 1730
1780 OPEN#0, "ACCT"
1790 IF M=N+1 THEN 1800 ELSE 1820
1800 WRITE#0 %245,M,NOENDMARK
1810 WRITE#0 %93*(M-N5)+250,M,A,A$,D$,C$,R,C,E,B$,S$,R$ \GOTO 1920
1820 WRITE#0 %93*(M-N5)+250,M,A,A$,D$,C$,R,C,E,B$,S$,R$,NOENDMARK
1830 READ#0 %5,A1,B1,C1
```

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```
1840 J=0
1850 REM REMOVE 'OLD' EFFECT ON HEADER BALANCE
1860 REM WHEN MODIFYING RECORD
1870 IF A1=A2 THEN C1=C1-C2-R2+E2 ELSE 1900
1880 WRITE#0 %15+(15*J),C1,NOENDMARK
1890 GOTO 1920
1900 READ#0,A1,B1,C1
1910 J=J+1\GOTO 1870
1920 READ#0 %5,A1,B1,C1
1930 J=0
1940 REM ADJUST HEADER BALANCE
1950 IF A1=A THEN C1=C1+C+R-E ELSE 1970
1960 GOTO 2040
1970 READ#0,A1,B1,C1
1980 J=J+1
1990 REM DISALLOW INVALID OBJECT CODES
2000 IF J>15 THEN !"OBJECT CODE NOT FOUND." ELSE 2030
2010 WRITE#0 %245,N,NOENDMARK
2020 CLOSE#0\GOTO 110
2030 GOTO 1950
2040 WRITE#0 %15+(15*J),C1,NOENDMARK
2050 CLOSE#0
2060 IF M=N+1 THEN 2160
2070 !
2080 IF X$="Y" THEN INPUT "DO YOU WISH TO MODIFY ANOTHER RECORD?
2090 P$=P$+L2$                                            .",P$ ELSE 2160
2100 REM RESPONSE CAN BE\ Y,N,RETURN OR RECORD #
2110 IF P$(1,1)=" " THEN 110
2120 IF P$(1,1)="Y" THEN 280
2130 IF P$(1,1)="N"THEN 110
2140 M=VAL(P$)
2150 GOTO 340
2160 IF X$(1,1)="N" THEN N=N+1
2170 IF X$(1,1)="N" THEN 370
2180 !\!\!\!\!\!\!
2190 !"                    **********"
2200 !\!
2210 GOTO 470
2220 CHAIN "SSRCH"
2230 CHAIN "DISP"
2240 CHAIN "DIVDIS2"
2250 CHAIN "CANT"
2255 CHAIN "UPDATE"
2260 REM CUSTOM ERROR MESSAGE
2270 IF Q1=12 THEN 2280 ELSE STOP
2280 !"OBJECT CODE MUST BE A NUMBER. PLEASE RETYPE."\GOTO 810
2290 END
READY



LOAD DISP
READY
LIST
10 REM DISP PROGRAM
20 DIM B$(13)
30 OPEN#0, "ACCT"
40 READ#0,N5
50 READ#0 %245,N
55 IF N5-N=1 THEN 90
60 READ#0 %93*(N-N5)+250,M,A,A$
70 !TAB(35),"DATE OF LAST ENTRY: ",A$
80 !TAB(40),"LAST REC. NO.: ",M
90 !"OBJECT CODE",TAB(20),"APPROVED",TAB(45),"BALANCE"
100 READ#0%0,N5
110 FOR J=1 TO 16
120 READ#0,A,B,C
130 READ B$
140 !A,TAB(6),B$|%$C#12F2,TAB(20),B,TAB(45),C,%#
150 NEXT J
160 CLOSE#0
170 !\!\!
180 INPUT"PRESS RETURN TO CONTINUE",A$
190 !\!\!
200 CHAIN "BUDGET"
210 DATA "REVENUE","CHARGEBACK","TRAVEL","PHONE(LOCAL)","PHONE(L.D.
220 DATA "PRINTING","OFFICE","PHOTO","EQUIPT.PARTS","SHIPPING"
230 DATA "MAG.TAPE","BULBS,ACC.","FILM MAINT.","SERIALS","EQUIPT."
240 DATA "  (AVAILABLE)"
250 END
READY



LOAD DIVDIS
READY
LIST
10 REM 'DIVDIS' DISPLAYS BALANCES BY DIVISION
20 REM REC. NO.'S ARE STORED IN RAM STARTING AT 0000
30 DIM D$(13),C$(30),D1$(1),A$(8),B$(8),S$(8),R$(1)
40 OPEN#0, "ACCT"
50 REM N=NUMBER OF RECORDS IN FILE
60 READ#0 %245,N
70 REM A$=DATE OF LAST ENTRY
80 READ#0 %93*(N-1)+250,M,A,A$
90 INPUT "WHICH DIVISION?: ",D$\D$=D$+L$
100 IF D$(1,1)=" " THEN CLOSE#0
110 IF D$(1,1)=" " THEN CHAIN "BUDGET"
120 !\INPUT "WHICH MONTH? (NUMBER OR 'ALL'): ",M$\M$=M$+L$
130 R2=0
140 C2=0
150 E2=0
160 T=0
170 REM F=NUMBER OF MATCHES FOUND
180 F=0
190 !TAB(50),"DATE OF LAST ENTRY: ",A$
200 !\!"OBJ. CODE",TAB(25),"REVENUE",TAB(42),"CHARGEBACK",TAB(61),"
210 REM STEP THROUGH HEADER RECORDS                    EXPENDITURE"\!
220 FOR J=1 TO 15
230 READ#0 %15*(J-1)+5,A1,B1,C1
240 REM ROUTINE TO CHECK DIV.,DATE/STORE REC. NO.S/PRINT MATCHES
250 GOSUB 540
260 NEXT J
270 CLOSE#0
280 IF R2+C2+E2=0 THEN !"NO TRANSACTIONS FOUND FOR ",D$
290 IF R2+C2+E2=0 THEN 520
300 !TAB(20),"------------",TAB(40),"------------",TAB(60),"------
310 !%$C#12F2,TAB(20),R2,TAB(40),C2,TAB(60),E2                    ------"
320 T=T+E2-C2-R2
330 !
340 !TAB(20),"TOTAL INCOME: ",R2+C2,TAB(50),"NET EXPENDITURE: ",T,%#
350 !"RECORD # LIST: "
360 FOR K=1 TO F
370 ! EXAM(K-1),
380 NEXT K
390 !\INPUT"WOULD YOU LIKE DESCRIPTIONS OF THE TRANSACTIONS?"
400 IF X$(1,1)<>"Y" THEN 520                                ,X$\X$=X$+L$
410 OPEN#0,"ACCT"
420 REM GET REC. NO.S FROM RAM
430 FOR K=1 TO F
440 W=EXAM(K-1)
450 READ#0%93*(W-1)+273,C$,R,C,E,B$,S$,R$
460 !W,TAB(12),C$,TAB(44),B$,R,C,E,"(",R$,")"
470 REM Z = PAGING
480 Z=Z+1
490 IF Z=6 THEN INPUT"PRESS RETURN TO CONTINUE....",X$
500 IF Z=6 THEN Z=0
510 NEXT K\CLOSE#0
520 INPUT" WANT TO DISPLAY ANY OTHER DIVISIONS? ",X$\X$=X$+L$
530 IF X$(1,1)="Y" THEN 40 ELSE CHAIN "BUDGET"
540 R1=0
550 C1=0
560 E1=0
570 FOR I=1 TO N
580 READ#0 %93*(I-1)+250,M,A,A$,D1$,C$,R,C,E,B$,S$,R$
590 IF D1$<>D$(1,1) THEN 750
600 IF A<>A1 THEN 750
610 IF M$(1,3)="ALL" THEN 650
620 G1=VAL(A$)
630 G=VAL(M$)
640 IF G=G1 THEN 650 ELSE 750
650 IF INT(V/100)<INT(A/100) THEN !
660 V=A
670 REM STORE REC NO.S IN RAM
680 FILL F,M
690 F=F+1
700 REM IGNORE 'CANCELLED'S
710 IF R$="C" THEN 750
720 C1=C1+C
730 E1=E1+E
740 R1=R1+R
750 NEXT I
760 IF R1+C1+E1=0 THEN RETURN
770 !A1,TAB(20),%$C#12F2,R1,TAB(40),C1,TAB(60),E1,%#
780 R2=R2+R1
790 C2=C2+C1
800 E2=E2+E1
810 RETURN
READY



LOAD DIVDIS2
READY
LIST
10 REM DVDIS2
20 !"DISPLAY EXPENSES FOR"
30 DIM L$(30),A$(8),D$(1),C$(30),X$(1),R$(1),S$(8)
40 INPUT "WHICH DIVISION?: ",X$\X$=X$+L$
50 !
60 INPUT "WHICH MONTH ? (1-12 OR 'ALL'): ",Y$\Y$=Y$+L$
70 OPEN#0,"ACCT,2"
80 OPEN#1,"ACCT"
90 READ#1,F1
100 READ#1%245,N
```

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CIRCLE 350 ON READER SERVICE CARD

```
110 REM READ ALL RECORDS
120 FOR J=1TO N-F1+1
130 READ#1%93*(J-1)+250,M,A,A$,D$,C$,R,C,E,B$,S$,R$
140 REM SAVE LAST DATE
150 A2$=A$
160 REM CHECK FOR DIVISION
170 IF D$<>X$ THEN 240
180 REM CHECK FOR MONTH
190 IF Y$(1,3)="ALL" THEN 230
200 Y=VAL(Y$)\Y1=VAL(A$)
210 IF Y<>Y1 THEN 240
220 REM STORE MATCHES IN BUFFER FILE
230 WRITE#0,M,A,A$,D$,C$,R,C,E,B$,S$,R$
240 NEXT J
250 CLOSE#1
260 REM BEEP OUR KEYBOARD (IKB-1)
270 OUT 20,0
280 INPUT "ANY MORE DISCS? ",Z$\Z$=Z$+L$
290 IF Z$(1,1)=" " THEN 360
300 IF Z$(1,1)="N" THEN 360
310 !
320 !"LOAD NEW DISC ONTO DRIVE #1."
330 INPUT "WHEN NEW DISC IS LOADED TYPE 'READY'... ",Z1$\Z1$=Z1$+L$
340 IF Z1$(1,5)="READY" THEN 80 ELSE 330
350 REM START DISPLAY
360 !TAB(40),"DATE OF LAST ENTRY: ",A2$
370 !"OBJ. CODE",TAB(17),"REVENUE",TAB(34),"CHARGEBACK",TAB(53),
380 !TAB(68),"NET EXPENSE"                                "EXPENDITURE",
390 OPEN#1,"ACCT"
400 R2=0\C2=0\E2=0\T2=0
410 REM READ HEADER RECORDS
420 FOR J=1 TO 17
430 READ#1%(J-1)*15+5,A2,B2,C3
440 REM RESET BUFFER POINTER
450 CLOSE#0\OPEN#0,"ACCT,2"
460 REM READ ALL BUFFER RECORDS
470 IF TYP(0)=0 THEN 580
480 READ#0,M,A,A$,D$,C$,R,C,E,B$,S$,R$
490 REM MATCH OBJECT CODES
500 IF A2<>A THEN 470
510 REM REJECT 'CANCELLED' RECORDS
520 IF R$="C" THEN 470
530 REM KEEP TOTALS
540 R1=R1+R
550 C1=C1+C
560 E1=E1+E
570 GOTO 470
580 T=E1-R1-C1
590 REM IGNORE INACTIVE ACCOUNTS
600 IF T=0 THEN 650
610 REM PRINT ACTIVE ACCOUNTS
620 !\!A2,%$C#12F2,TAB(12),R1,TAB(32),C1,TAB(52),E1,TAB(65),T,%#
630 R2=R2+R1\C2=C2+C1\E2=E2+E1\T2=T2+T
640 R1=0\C1=0\E1=0\T=0
650 NEXT J
660 CLOSE#1\CLOSE#0
670 !TAB(12),"------------",TAB(32),"------------",TAB(52),
    "------------",TAB(68),"------------"
680 !%$C#12F2,TAB(12),R2,TAB(32),C2,TAB(52),E2,TAB(68),T2,%#
690 INPUT "DO YOU WANT DETAILS OF TRANSACTIONS? : ",Y$\Y$=Y$+L$
700 IF Y$(1,1)="Y" THEN 730
710 CHAIN "BUDGET"
720 REM DISPLAY DETAILS FROM BUFFER FILE
730 OPEN#0,"ACCT,2"
740 IF TYP(0)=0 THEN 810
750 READ#0,M,A,A$,D$,C$,R,C,E,B$,S$,R$
760 !M,TAB(12),C$,TAB(44),B$,R,C,E,"( ",R$," )"
770 Z=Z+1
780 IF Z=6 THEN INPUT "PRESS RETURN TO CONTINUE... ",Z$\Z$=Z$+L$
790 IF Z=6 THEN Z=0
800 GOTO 740
810 CLOSE#0
820 INPUT "WANT TO DISPLAY ANY OTHER DIVISIONS? : ",Z$\Z$=Z$+L$
830 IF Z$(1,1)="Y" THEN 40 ELSE CHAIN "BUDGET"
READY
```

```
LOAD CANT
READY
LIST
10 REM 'CANT' PROGRAM WILL CANCEL A TRANSACTION
20 REM AMOUNTS ARE REMOVED FROM TOTALS BUT DETAILS ARE
30 REM RETAINED UNDER REC. NO. AND STATUS BECOMES 'C'
40  DIM R$(1),C$(30),D$(1)
50 OPEN#0, "ACCT"
60 READ#0,N5
70 READ#0 %245,N
80 !"THIS FILE CONTAINS RECORD NO.'S ",N5," THROUGH ",N
90 INPUT" WHICH RECORD DO YOU WISH TO CANCEL? ",X
100 IF X=0 THEN CLOSE#0
110 IF X=0 THEN 430
120 IF X>N THEN 80
130 IF X<N5 THEN 80
140 READ#0 %93*(X-N5)+250,M,A,A$,D$,C$,R,C,E,B$,S$,R$
150 !\!\!"RECORD#: ",M,"                    ",B$,"( ",D$," ) ",A$
160 !C$," RE: ",S$
170 !A,TAB(20),%$C#12F2,R,TAB(40),C,TAB(60),E,%#
180 IF R$="C" THEN !" THIS TRANSACTION HAS ALREADY BEEN CANCELLED!!!!"
190 IF R$="C" THEN 420
200 !"STATUS: ",R$
210 !\!\INPUT "DO YOU WISH TO CANCEL THIS TRANSACTION? : ",X$\X$=X$+L$
220 IF X$(1,1)="Y" THEN 270
230 CLOSE#0
240 !"THIS TRANSACTION WILL NOT BE CANCELLED"
250 GOTO 420
260 REM MODIFY STATUS
270 R$="C"
280 WRITE#0 %93*(X-N5)+90+250 ,R$,NOENDMARK
290 REM FIND,MODIFY HEADER BALANCES
300 READ#0%0,N5
310 FOR J=1 TO 16
320 READ#0,A1,B1,C1
330 IF A=A1 THEN EXIT 350
340 NEXT J
350 C1=C1-R-C+E
360 WRITE#0%15*(J-1)+15,C1,NOENDMARK
370 CLOSE#0
380 !\!\!
390 !"THIS TRANSACTION HAS NOW BEEN CANCELLED.  IT NO LONGER AFFECTS
    THE"
400 !"ACCOUNT BALANCES AND IT MAY NOT BE MODIFIED FURTHER."
410 !\!\!
420 !\INPUT "PRESS RETURN FOR MENU...",X$
430 CHAIN "BUDGET"
READY
PSIZE
5 BLOCKS
READY
LOAD POS
READY
LIST
10 REM 'POS' SEARCHES FOR P.O.# AND PRINTS DETAILS
20 DIM X$(8),B$(8),C$(30)
30 OPEN#0,"ACCT"
40 READ #0,N5
50 READ#0%245,N
60 !\INPUT"WHICH P.O.# ?: ",X$\X$=X$+L$
70 FOR J= 1 TO N-N5+1
80 READ#0%250+93*(J-1),M,A,A$,D$,C$,R,C,E,B$,S$,R$
90 IF B$=X$ THEN EXIT 160
100 NEXT J
110 !\!\!"  *** THERE IS NO RECORD OF P.O.# ",X$," ***"\!\!
120 INPUT"ANY OTHERS ? : ",X$\X$=X$+L$
130 IF X$(1,1)="N" THEN 250
140 IF X$(1,1)=" " THEN 250
150 IF X$(1,1)="Y" THEN 60 ELSE 70
160 IF R>0 THEN E1=R
170 IF C>0 THEN E1=C
180 IF E>0 THEN E1=E
190 !\!"P.O.# ",X$,TAB(30),A$,TAB(50),%$C11F2,E1
200 !C$," FROM ",S$,"       (RECORD NO. : ",M," )"
210 IF R$="R" THEN!"RECEIVED"
220 IF R$="O" THEN!"NOT COMPLETE"
230 IF R$="C" THEN!"CANCELLED"
240 !\!\GOTO 120
250 CLOSE#0
260 CHAIN "BUDGET"
READY
```

```
LOAD SSRCH
READY
LIST
10 !\!\!"  ** SUPER-SEARCH **"\!\!
20 !"ENTER DATA YOU WISH TO SEARCH FOR OR PRESS RETURN.."\!\!
30 DIML$(30),C1$(1),D1$(1),C$(30),A$(8),D$(1),R$(1),B$(8),S$(8)
40 DIM B1$(8),S1$(8),R1$(1),Q$(8)
50 !
60 INPUT "OBJECT CODE: ",A1$\A1$=A1$+L$
70 !
80 INPUT "MONTH (1 TO 12): ",A2$\A2$=A2$+L$
90 !
100 INPUT "DIVISION (G,M,F,W,E,P): ",D1$\D1$=D1$+L$
110 !
120 INPUT "P.O./RECEIPT#: ",B1$\B1$=B1$+L$
130 !
140 INPUT "SUPPLIER/DESCR.: ",S1$\S1$=S1$+L$
150!
160 !"DO YOU WANT TO SPECIFY "
170 !"                  1. THE EXACT SUPPLIER NAME, OR"
180 !"                  2. JUST THE FIRST LETTER?"
190 !\INPUT " TYPE 1 OR 2 : ",Q$\Q$=Q$+L$
200 !
```

DYNACOMP

Quality software for: PET
Apple II Plus
TRS-80 (Level II)
North Star

All software is supplied with complete documentation which includes clear explanations and examples. Each program will run with standard terminals (32 characters or wider) and within 16K program memory space. Except where noted, all software is available on PET cassette, North Star diskette (North Star BASIC), TRS-80 cassette (Level II) and Apple cassette (*Applesoft* BASIC). These programs are also available on *PAPER TAPE* (Microsoft *BASIC*).

BRIDGE 2.0 **Price: $17.95 postpaid**

An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice.

HEARTS 1.5 **Price: $14.95 postpaid**

An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies.

FLIGHT SIMULATOR **Price: $17.95 postpaid**
(as described in SIMULATION, Volume II)

A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers.

SIMULATION, Volume II (BYTE Publications): $6.00

VALDEZ **Price: $14.95 postpaid**

A simulation of supertanker navigation in the Prince William Sound and Valdez Narrows. The program uses an extensive 256X256 element radar map and employs physical models of ship response and tidal patterns. Chart your own course through ship and iceberg traffic. Any standard terminal may be used for display.

CHESS MASTER **Price: $19.95 postpaid (available for North Star and TRS-80 only)**

This complete and very powerful program provides five levels of play. It includes castling, en passant captures, and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users.

FOURIER ANALYZER **Price: $14.95 postpaid**

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TEXT EDITOR I (Letter Writer) **Price: $14.95 postpaid**

An easy to use, line-oriented text editor which provides variable line widths and simple paragraph indexing. This text editor is ideally suited for composing letters and is quite capable of handling much larger jobs.

MAIL LIST II **Price: $19.95 postpaid (available for North Star only)**

This many-featured program now includes full alphabetic and zip code sorting as well as file merging. Entries can be retrieved by user-defined code, client name or Zip Code. The printout format allows the use of standard size address labels. Each diskette can store more than 1000 entries (single density; over 2000 with double density systems)!

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C Compiler for CP/M*

New, and available now! An easily affordable compiler incorporating most of the features of the full C language.

BD SOFTWARE

System requirements: CP/M and at least 24K of RAM

Variable Types: char, int, unsigned

Composite Types: arrays, structures, unions

Pointers: to variables, structures, unions and functions

Features: is a structured language, all functions (Programs) recursive; more powerful expression operators than any other von Neumann type language; allows free-formatted source; close enough to UNIX** C to make conversions feasible.

Speed: On 2 MHz 8080, the statement

```
for (i = 1; i < 30000; i++) x = 5;
```

takes about 4 seconds to execute.

Package contains: compiler, linker, library manager; standard function library; sample source files include games, a terminal emulator with disk I/O plus the source for many standard library functions; BDS C User's Guide; Book—*The C Programming Language* by Dennis Ritchie and Brian Kernighan of Bell Labs. ***Price:* $125**

Recipient of the Computer Lib Seal of Approval **Manual Alone $20**

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```
210 INPUT "STATUS (O,R,C): ",R1$\R1$=R1$+L$
220 !
230 INPUT "REVENUE,CHARGEBACK,EXPENDITURE (R,C,E): ",C1$\C1$=C1$+L$
240 REM DISPLAY PAGING
250 K=21\!\!
260 OPEN #0,"ACCT"
270 READ#0,N5
280 READ#0%245,N
290 REM MATCH FOUND FLAG
300 Y=0
310 FOR J=1 TO N-N5+1
320 READ#0%93*(J-1)+250,M,A,A$,D$,C$,R,C,E,B$,S$,R$
330 IF A1$(1,1)=" " THEN 350
340 IF VAL(A1$)=A THEN 350 ELSE 610
350 IF A2$(1,1)=" " THEN 370
360 IF VAL(A2$)=VAL(A$) THEN 370 ELSE 610
370 IF D1$(1,1)=" " THEN 390
380 IF D1$=D$ THEN 390 ELSE 610
390 IF B1$(1,1)=" " THEN 410
400 IF B1$=B$ THEN 410 ELSE 610
410 IF S1$(1,1)=" " THEN 440
420 IF S1$=S$ THEN 440 ELSE 430
430 IF Q$(1,1)="2" THEN IF S1$(1,1)=S$(1,1) THEN 440 ELSE 610
440 IF R1$(1,1)=" " THEN 460                                         ELSE 610
450 IF R1$=R$ THEN 460 ELSE 610
460 IF C1$(1,1)=" " THEN 540
470 REM TEST MATCH FOR R,C,E
480 V=0
490 IF C1$(1,1)="R" THEN V=R
500 IF C1$(1,1)="C" THEN V=C
510 IF C1$(1,1)="E" THEN V=E
520 IF V>0 THEN 540 ELSE 610
530 REM PRINT MATCHES
540 !M,"  ",A,"  ",A$,"  ",D$,"   ",C$
550 !%$C11F2,R,C,E,"  ",B$,"  ",S$,"   ",R$,%$
560 !
570 Y=1
580 K=K-3
590 IF K=0 THEN INPUT "PRESS RETURN TO CONTINUE",V$
600 IF K=0 THEN K=21
610 NEXT J
620 CLOSE#0
630 IF Y=0 THEN 670
640 !"SEARCH COMPLETE. ENTER M  FOR MENU"
650 INPUT "                  ENTER S FOR ANOTHER SEARCH",V$\V$=V$+L$
660 IF V$(1,1)="S" THEN 50 ELSE CHAIN "BUDGET"
670 !\!"****** NO MATCH FOUND FOR THIS DATA ******"\!
680 !"DATA:",A1$,A2$,D1$,B1$,S1$,R1$,C1$
690 !
700 INPUT "DO YOU WANT TO SEARCH ANOTHER DISC FOR THIS DATA? ",
710 IF V$(1,1)="N" THEN 740                           V$\V$=V$+L$
720 INPUT "INSERT NEW DISC AND PRESS RETURN TO CONTINUE",V$
730 GOTO 250
740 INPUT "WANT TO DO ANOTHER SEARCH? ", V$\V$=V$+L$
750 IF V$(1,1)="Y" THEN 50 ELSE CHAIN "BUDGET"
760 END
READY
```

```
LOAD UPDATE
READY
LIST

10 REM UPDATE PROGRAM
20 !"          *** UPDATE PROGRAM ***"
30 !\!\!
40 !" PLACE DISC TO BE UPDATED IN DRIVE#2 AND PREVIOUS DISC IN
50 !\!\INPUT"THEN PRESS RETURN TO CONTINUE... ",Z$           DRIVE#1"
60 !\!\!\!
70 DIM N5(2),N(2),C(16,2),T(16)
80 OPEN#1,"ACCT"
90 OPEN#2,"ACCT,2"
100 READ#1%260,D$
110 Y1=FNA(D$)
120 READ#2%260,D$
130 Y2=FNA(D$)
140 IF Y1=Y2 THEN 170
150 !"THESE TWO DISCS DO NOT REFER TO THE SAME YEAR.....
160 GOTO 380                                           PLEASE CORRECT."
170 FOR I=1 TO 2
180 READ#I%0,N5(I)
190 FOR J=0 TO 15
200 READ#I%5+(J*15),A,B,C(J+1,I)
210 NEXT J
220 READ#I%245,N(I)
230 NEXT I
240 IF N5(2)=N5(1) THEN N5(2)=N(1)+1
250 WRITE#2%0,N5(2),NOENDMARK
260 IF N5(2)=N(1)+1THEN 290
270 !"THESE DISCS ARE NOT SEQUENTIAL....PLEASE CORRECT."
280 GOTO 380
290 FOR I=1 TO 16
300 READ#1%250+93*(N(1)-N5(1)+1)+5*(I-1),T(I)
310 IF C(I,1)=T(I) THEN 360
320 C(I,2)=C(I,2)+C(I,1)-T(I)
330 T(I)=C(I,1)
340 WRITE#1%250+93*(N(1)-N5(1)+1)+5*(I-1),T(I),NOENDMARK
350 WRITE#2%15*I,C(I,2),NOENDMARK
360 NEXT
370 !"THESE DISCS ARE UPDATED "
380 CLOSE#1\CLOSE#2
390 END
400 DEF FNA(D$)
410 FOR I=4 TO 6
420 IF D$(I,I)="/" THEN Y$=D$(I+1,I+2)
430 NEXT
440 Y=VAL(Y$)
450 IF VAL(D$)<5 THEN Y=Y-1
460 RETURN Y
470 FNEND
READY
```

```
LOAD ANEW
READY
LIST

10 REM 'ANEW' PROGRAM USED TO INIT NEW DATA FILE CALLED 'ACCT'
20 !"****** WARNING!! ******"\!\!
30 !"THIS PROGRAM IS DESIGNED TO INITIALIZE A DATA FILE CALLED 'ACCT'"
40 !"AND WILL DESTROY ANY DATA ON THE FILE.  IT CONTAINS DATA"
50 !"SPECIFIC TO (YOUR DEPT.'S) 79-80 BUDGET YEAR."
60 !\!\!\!
70 INPUT "DO YOU WISH TO PROCEED? (Y/N) ",T$\T$=T$+L$
80 IF T$(1,1)="Y" THEN 90 ELSE 280
90 N5=1\REM N5=FIRST RECORD# IN FILE
100 N=N5-1\REM N=LAST RECORD# IN FILE
110 OPEN#0, "ACCT"
120 WRITE #0,N5
130 FOR J = 1 TO 16
140 READ A,B,C
150 WRITE#0,A,B,C
160 NEXT J
170 WRITE#0,N
180 CLOSE #0
190 !\!\!\!\!
200 !"   DATA FILE 'ACCT' IS NOW INITIALIZED"
210 REM DUMMY DATA TO ILLUSTRATE STRUCTURE
220 DATA 121,0,0,122,0,0,371,1000,1000
230 DATA 454,2000,2000,455,3000,3000,560,4000,4000
240 DATA 601,5000,5000,602,6000,6000
250 DATA 616,7000,7000,619,8000,3000
260 DATA 623,9000,9000,624,8000,8000,642,7000,7000,645,6000,6000
270 DATA 762,5000,5000,0,0,0
280 CHAIN "BUDGET"
290 END
READY
```

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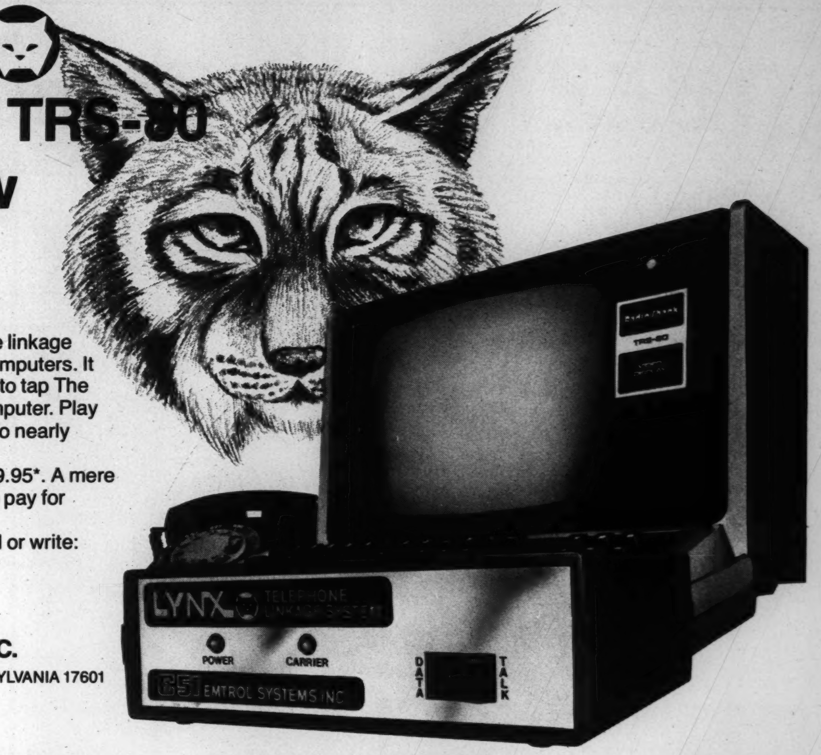

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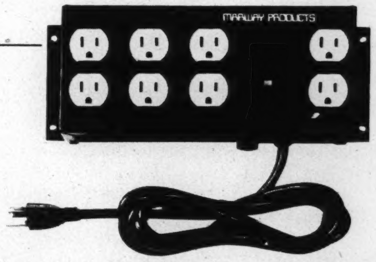

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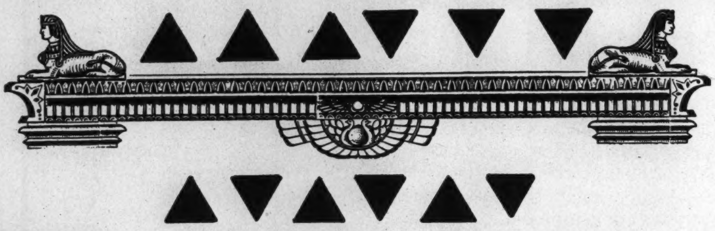
CIRCLE 210 ON READER SERVICE CARD

puzzles & problems



Pyramid Power

Lost puzzles and lost civilizations. From the valley of the Nile comes this ancient and venerable problem. Above the altar in the diagram are positioned six pyramids. The problem is to rearrange them so that they will be positioned as shown under the altar. The rules for effecting this change are as follows: (1) It must be done in 3 moves. (2) You must move two *adjacent* pyramids during each move. (3) A move is considered turning a pyramid end for end. (4) Each pyramid must remain in the same spot after it has been inverted. May the Pyramid Power be with you!

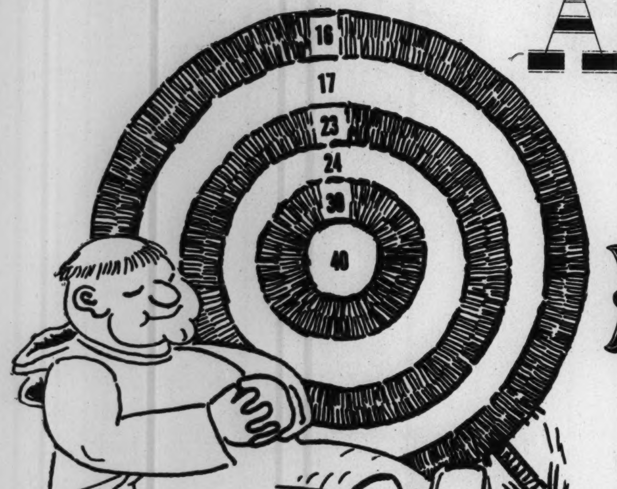
Money Talks

Mr. Wilson Rowland, of Silver Spring, Maryland, writes: "I'm writing about 'A Valuable Problem' on page 133 of the August 1979 issue of *Creative Computing.* Eleven sleds/coins were to be put *on the ground* forming seven rows of four. The solution on page 160 is somewhat tricky in that only eight of the sleds/coins touch the ground. Accepting this method of solution, however, I offer the observation that it is possible to form more rows of *four* from *fewer* objects. Thus, rather than seven rows from eleven objects, ten rows, of four coins each, can be formed using only ten coins."

"That's a challenging problem for our readers to take on. Mr. Rowland, a copy of "Merlin's Puzzler 1" is on the way to you.

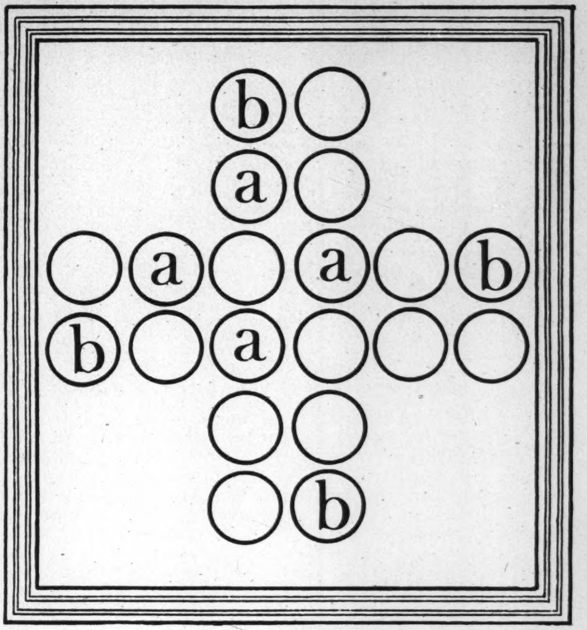
A Cigar Puzzle

A hobo, after collecting 25 cigar butts, sat himself down in the shade and rolled himself some fresh cigars. He could make one fresh cigar out of 5 butts. How many cigars was our hobo friend able to manufacture from his original stock of cigar butts?



The Perfect Score

Here we see Friar Tuck, that roguish monk of Robin Hood's band of outlaws, slumbering through the afternoon when he is supposed to be keeping an eye on the castle of the Sheriff of Nottingham. Earlier in the day he had been trying with his bow and arrows, to win a bet he has made with Robin. The problem is to shoot a number of arrows into the target so that the score will total exactly 100. Judging by the smile on his face, I'd guess that Friar Tuck thinks he knows the answer and can already taste the prize. Do you know how many arrows it would take to score 100? (From "Merlin's Puzzler 1").



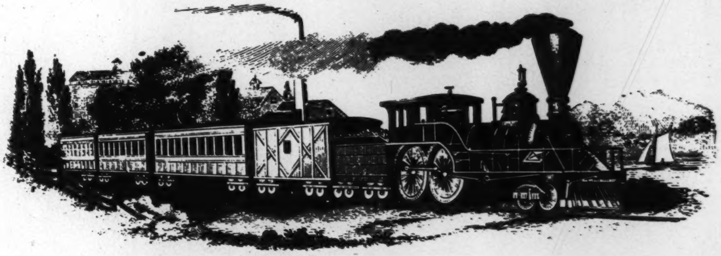
The Square Puzzle

In the diagram at the left we have twenty circles arranged in the form of a cross. How many perfect squares can you see in this cross when you consider any four circles as being the corners of the square. Look at the diagram and you will see what I mean. The four squares, which contain the letter *a*, form the corners of one square. Also, the four circles containing the letter *b* form another square. This should keep you busy for awhile.

One other little puzzle you might try, when you have solved the foregoing, is to remove six of the circles from the cross so that it is impossible to form any squares from the remining circles. (From "Merlin's Puzzler 2").

The Choo Choo Puzzle

Two boys were out walking along the railroad tracks on a hot summer's day. In order to escape the heat, they went into a tunnel. They walked two fifths of the way in and stood there. Suddenly they heard a train approaching the end of the tunnel closest to them. Both boys ran. They each ran at 15 M.P.H., but in opposite directions. Luckily, each of them just made it to their respective ends of the tunnel, to escape without being clipped by the train's engine. Question: How fast was the train going? (This puzzle was sent in to us by Mr. Taber L. Bucknell of Ontario, Canada. Many thanks Mr. Bucknell, Merlin is sending you a copy of "Merlin's Puzzler 2" for sharing this interesting puzzle with us).



A Groovy Problem

How many grooves are there on an *average*, old time, 10-inch 78 r.p.m. record by Paul Whiteman and his orchestra? (1) 1000, (2) 1500, (3) 2000, (4) 2500, (5) 3000.

A Common Problem

Our last puzzle deals with how keen your powers of observation are. The following eight words all have one thing in common. What is it? The words are: *deft, first, calmness, canopy, laughing, stupid, crabcake, hijack?*

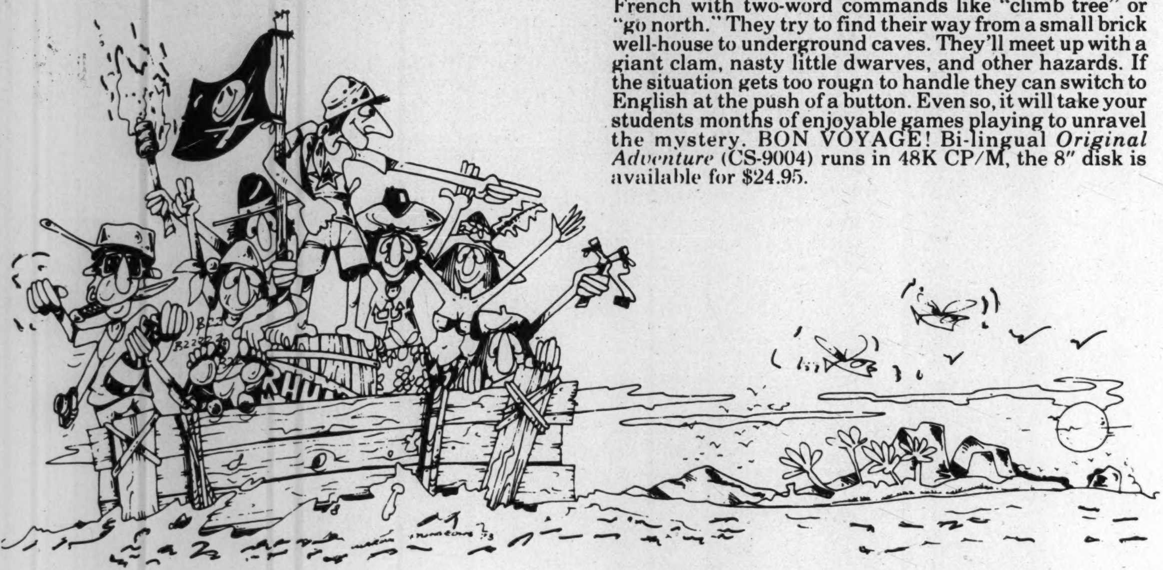
If you would like to purchase "Merlin's Puzzler 1, 2 or 3" write to Merlin in care of *Creative Computing*. Each book is 8½" x 11", 128 pages long. If you have any puzzles that you would like to try and stump our readers with, send them along to Merlin. If he uses your puzzle he will send you a copy of one of his books.

Your Editor,
Charles Barry Townsend

creative computing
EDUCATIONAL SOFTWARE

Learn French in One Easy ADVENTURE

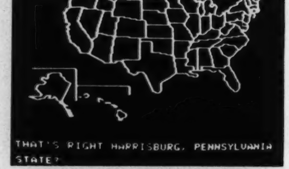
Take your students to an enchanted land filled with French speaking characters and send them on a treasure hunt. They direct their computer puppet in French with two-word commands like "climb tree" or "go north." They try to find their way from a small brick well-house to underground caves. They'll meet up with a giant clam, nasty little dwarves, and other hazards. If the situation gets too rougn to handle they can switch to English at the push of a button. Even so, it will take your students months of enjoyable games playing to unravel the mystery. BON VOYAGE! Bi-lingual *Original Adventure* (CS-9004) runs in 48K CP/M, the 8" disk is available for $24.95.



Creative Computing offers a wide variety of uncomplicated user-oriented educational programs. **Study Made Easy** for the PET (CS-1202) will create study drill tapes for any subject automatically. The computer guides you, step by step, through the entry of questions and multiple choice answers. The package includes three prepared drills. From U.S. Presidents to Lacrosse rules, the versatile programs of **Study Made Easy** will create study drills for you automatically. It's well worth the price of $14.95.

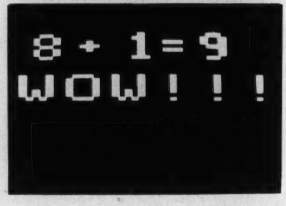
CAI Programs offers a diverse group of study aids. **U.S. Maps** uses high resolution graphics to help students learn the states and their capitols. **Spelling** increases its pace as you progress. **Math Drill and Add with Carry** will help you with mathematics basics at your skill level. The **Know Yourself** package (CS-4301) helps you investigate society's effects on your behavior, how your life style affects your life expectancy, and how your attitudes are affected by society's concept of sex roles. **CAI Programs** and **Know Yourself** are available individually on cassette for $7.95 each or on one disk (CS-4503) for only $14.95. Cassette versions will run in 16K and the disk requires 32K. These are for the Apple II.

Computer Assisted Instruction Programs



```
THAT'S RIGHT HARRISBURG, PENNSYLVANIA
STATE?
```

U.S. Map



```
8 + 1=9
WOW!!!
```

Math Drill

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The student using the **Malaria** program of the **Social, Economic, and Ecology Simulations** series actively designs his plan for the deployment of field hopitals, pesticides, remaining drugs for the ill and preventative medication. Then in a highly realistic simulation he carries out his strategy and receives prompt feedback about the effectiveness of his treatment. Because the student is personally responsible for economic, political, and scientific decisions he returns to his textbooks with renewed interest.

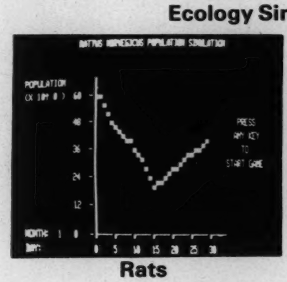
The series (which is based on models developed by The Huntington Two Computer Project) exposes students to problem solving in real world situations. **Ecology Simulations-1** (CS-3201) explores methods of population management. Students can cooperate to save the Wild West bison from extinction in **Buffalo.** The comprehensive introduction to modeling concepts is completed in **Pop, Sterl,** and **Tag.**

Ecology Simulations-2 (CS-3202) explores problems in environmental and health sciences. In **Malaria, Pollute, Rats,** and **Diet** the user can attempt to end water pollution, rats in a city slum, or to design a healthy diet. **Social and Economic Simulations** (CS-3204) allows students to experiment with a microcomputer version of the well-known "Limits to Growth" project in **Limits** or compete against each other in the bicycle industry in **Market; U.S. Pop** lets students investigate demographic concepts.

The series is designed for the 16K TRS-80 Level II and is attractively packaged in a vinyl binder. Included is a study guide which relates the material to current controversies, stimulates classroom discussion, and provides sample exercises. The series is also available on disk: **Ecology Simulations-1** (CS-3501), **Ecology Simulations-2**(CS-3502),and **Social and Economic Simulations** (CS-3508). At a modest $24.95 each, with quantity discounts available, the series becomes an affordable necessity.

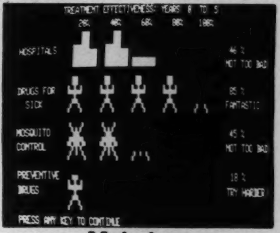
> **"In the classroom, this should be an ideal learning tool. Not only can students work on the mathematical effects of population growth but they can also see the social and ecological effects of any decisions they make…"**
>
> **"The manual is extremely well done. It provides necessary background information on each program and encourages the student to think about the social aspects of each program rather than just the mathematical processes."**
>
> **80 Software Critique on**
> **Ecology Simulations-1**
> **Jan-March 1980**

Ecology Simulations-2



PRESS ANY KEY TO START GAME

Rats



PRESS ANY KEY TO CONTINUE

Malaria

Apple Gradebook (CS-4506) brings the speed and accuracy of the computer to the teacher's traditional grading and record-keeping procedures. Gradebook stores and maintains all student records on disk. The package includes ten interlocking programs which lead you step by step, through setting up a class file and storing it on disk. These invaluable programs summarize the state of the class as a whole and then let you check on the progress of any individual. Apple Gradebook runs in 32K on Apple II and costs only $24.95.

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Effective Writing

Edmond H. Weiss, Ph.D.

Edmond H. Weiss, a communications consultant, teaches effective writing seminars for business, industry and government. To contact him call 609-795-5580.

Showing Off

If there is one thing that everyone who writes about writing will tell you it is this: *Don't Show Off.*

Orwell said, "Never use a long, unfamiliar word where a short familiar word will do." Gunning says, "Write to express, not to impress." Strunk and White say, "Avoid fancy words."

You would expect that after all this consistent advice that writers would be getting the message by now. But no. Every week I edit manuals and reports in which I have to change *utilize* to *use* a hundred times. Or *belatedly* to *late.* Or *subsequently* to *later.* Or *prioritize* (God help us) to *rank.* Just yesterday I had to comb through a proposal changing the phrase *facilitate or inhibit* to *help or hurt.*

Of course, we all know why this problem persists. Many insecure people still consider a large vocabulary and lots of big words to be the measure of intelligence. They are afraid that if they write plainly and simply no one will think them intelligent or college-educated.

Nonsense. The only people who need to couch simple ideas in ornate, difficult language are those con-men and hucksters who are trying to make ordinary commonsense statements sound technical or "professional." (We all know which "professions" those are, don't we.)

To put it bluntly, if you want to be a more effective writer, if you want to be respected and understood, then write as simply as you can. Don't be *simplistic* (that is, don't oversimplify difficult issues). Don't be patronizing (that is, don't talk down to intelligent readers). But don't go out of your way to snow us with your recondite vocabulary either.

Typical Offenders

Presume against any word with three or more syllables. When you find such a word in your first draft, stop and ask yourself if it could be replaced with a simpler substitute. (If you cannot substitute without hurting your meaning, then leave the longer word, of course.) Here are some examples I see every day.

Before	*After*
implementation	start, use
commencement	start, beginning
finalization	end, finish
interaction	talks
utilization	use
indication	sign
requirement	need
application	task, job
condition, situation	state, status
compensation, remuneration	pay, fee
capability	ability
reservation	doubt
conceptualization	sketch, idea, draft
furnish, provide	give
employ	use
formulate	make
inspect, investigate	check
ascertain	learn
possess, maintain	have
indicate, reveal	show, tell
transmit, disseminate	send
acknowledge	agree, grant
establish	prove, show
effectuate	cause
evaluate	rate, judge

Some Show-Offs I Have Known

Showing-off is more than an occasional big word. It is an attitude, a phony personality that sneaks into your letters, reports, or manuals. Beware of these characters:

The Lawyer, sometimes known as "The Cossell," is enamored of legal expressions; he is most likely to appear in your letters and agreements. For example:

> *Before:*
> As per your request, we are attaching hereto a copy of the aforesaid contract. Reference your inquiry regarding future training dates, please be advised that we will be sending same under separate cover.
>
> *After:*
> Here is a copy of the contract you asked for. We shall send along our training schedule in a little while.

The Stewardess relies entirely on stock phrases and standard speeches. She usually appears at the end of a letter. For example:

> *Before:*
> Should you find that you are in need of additional information regarding our services do not hesitate to communicate with a representative of our sales department.
>
> *After:*
> If you want to know more about our services just call someone in our sales department.

The *Invisible Man* thinks that a report is more impressive when it contains no personal pronouns. He is fond of sentences beginning with "It is," "It was," or "It has." For example:

> *Before:*
> It was expressed strongly that making the system as simple and easy to use as possible is an integral part of the CALC development.
>
> *After:*
> They insisted that CALC must be as easy to use as possible.

Be on guard for all show-offs. Notice the *Ambassador,* who never misses a chance to use and misuse a foreign word; he says *via* instead of *with,* and he usually gets *i.e.* and *e.g.* mixed up. Be wary of the *Counterfeiter* who likes to coin new words that we do not need (like *remediate* instead of *remedy,* or *orientate* instead of *orient,* or *designee* instead of *designate).* Watch our for the *Poet,* who likes to invent incomprehensible figures of speech; I heard a management consultant say that his client's company needed to get "a more tightly focused handle on the problem"!

Most of all, be careful of a character I have come to call the *Conehead,* after the alient creatures on TV's *Saturday Night Live.* Coneheads describe all processes and objects as though they were parts of a computer system; fathers are "male parental units" and homes are "domiciliary function stations."

There are lots of Coneheads in the computer word. Who but an alien could have written this?

> "The general interactions during and after the presentations made it clear that there were areas of security required by an operational TROL system which had not yet been documented and so did not exist in the security implementation on the prototype system?"

Oh yeah?

Next time: How Not to Write an Instruction. ☐

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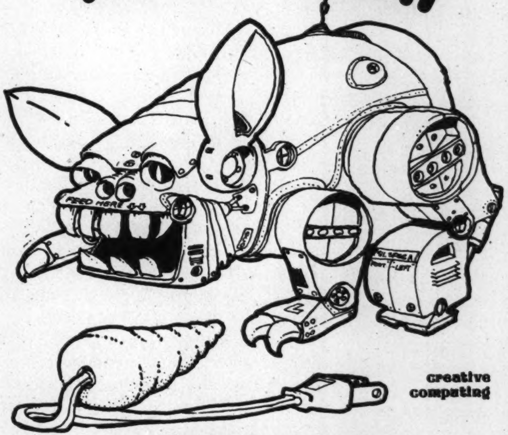
robot rabbit



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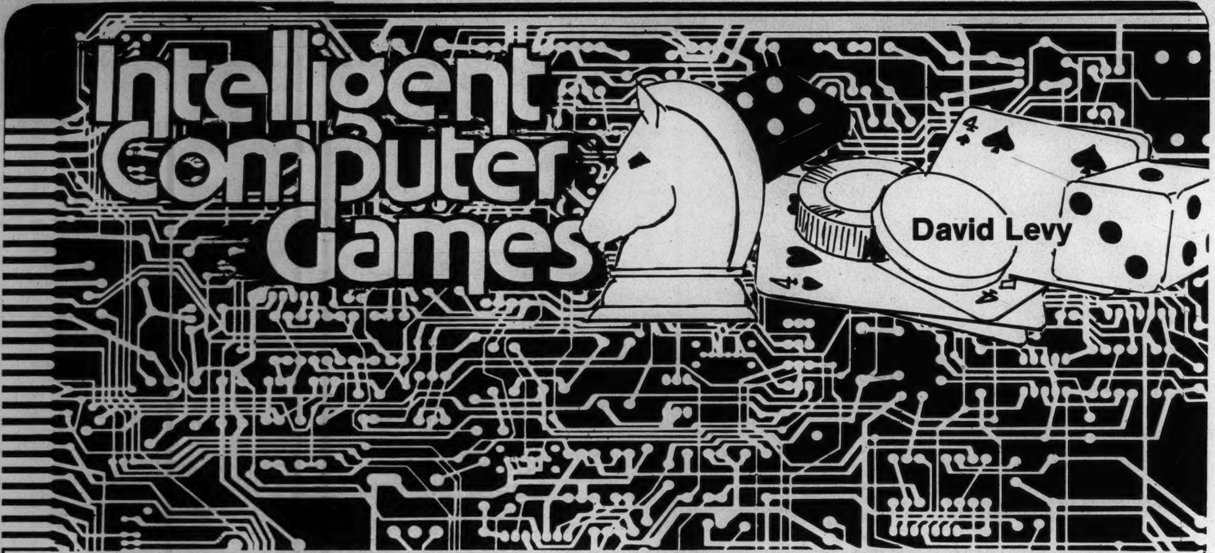

Intelligent Computer Games

David Levy

Correspondence is welcome. Letters with interesting questions and ideas will be used in the column along with a response. No personal replies can be made. Send to: David Levy, 104 Hamilton Terrace, London NW8 9UP, England

Checkers

Up to now this series has been devoted entirely to the general principles involved in writing programs to play intelligent games. This month we start on a new track, and the next several articles will describe specific games in some detail, commenting on the most notable work in each field. From now on I shall be happy to accept readers' letters for consideration. Letters should be written in English and addressed to me at 104, Hamilton Terrace, London NW8 9UP, England, and while I shall endeavour to answer the most interesting letters within future articles, *under no circumstances* will any reader receive a personal reply — I am simply much too busy.

The subject of the present article is the game of draughts, which is known as checkers in North America and dames throughout much of continental Europe. I have already described one of the learning techniques employed in Arthur Samuel's checker program and now we shall make a closer inspection of other aspects of this famous project. The article will conclude with some additional comments on computer learning, as applied to games.

Samuel's Checker Program

Arthur Samuel began to program checkers in 1952, when his program ran on an IBM 701 computer. It was rewritten for the IBM 704 in 1954 and the following year the first learning mechanism was introduced.

The fundamental program structure employed a minimax tree search, since the alpha-beta algorithm had not yet been invented. All moves were examined to a depth of 3-ply, and the program would look selectively at moves at the next ply, provided that:

1. The move was a capture;
2. The previous move was a capture; or
3. The move offers the opponent the chance to exchange men.

At the next ply the program ignored all moves for which the previous move was not a capture, and at deeper levels in the tree only capture moves were examined. By the time the program reached this depth the number of moves being examined from any position was small, but it was still possible for the program to find itself getting involved in ridiculous capture sequences, and so at a depth of 11-ply the search would terminate if either side were more than two kings ahead (an overwhelming advantage). At 20-ply the search terminated under all circumstances so that the program did not run out of memory for storing the tree.

Samuel's criteria for pruning the tree were chosen in such a way as to encourage the evaluation of positions that were quiescent, and to discourage evaluation in turbulent positions. The concepts of quiescence and turbulence are perhaps better understood when related to the two different aspects of game playing: strategy and tactics. Strategy involves planning and maneuvering. Tactics (e.g., capturing) are used to punish blunders and to convert a strategic advantage into something more concrete, such as material. The argument in favour of Samuel's approach is that the three ply of exhaustive search give the program some strategic grasp of what is happening, while the deeper tactical search ensures that it does not perform erroneous evaluations in turbulent positions. The necessity to restrict the deeper search in this way is clearly dependent on the nature of the game and the number of branches at each node of the tree (the branching factor). The number of positions evaluated in an alpha-beta search is roughly proportional to $b^{d/2}$ where b is the average branching factor and d is the depth of search, and anything that can be done to reduce the "b" will produce a combinatorial improvement in playing speed.

The evaluation function used in the early version of Samuel's program employed 39 terms or features, only 17 of which were in use at any one time. The features were temporarily suspended from duty if and when it was found that they did not contribute significantly to the evaluation process. Correlation measurements indicated which of the 17 features currently in use were the least effective, and once the effectiveness dropped below some threshold value they were replaced by the features at the top of the reserve list, while the rejects were added to the bottom of the reserve list. Material was the dominant feature, and Samuel recognized the need to encourage the program to trade off pieces when it was ahead but to avoid exchanges when behind. This may be accomplished in various ways, the most reliable is probably to determine the value of

$$\text{(program material} - \text{opponent's material)} \times \frac{\text{(greater side's material)}}{\text{(lesser side's material)}}$$

A full list of the other features in the linear part of the evaluation function is given below. In addition, there were some

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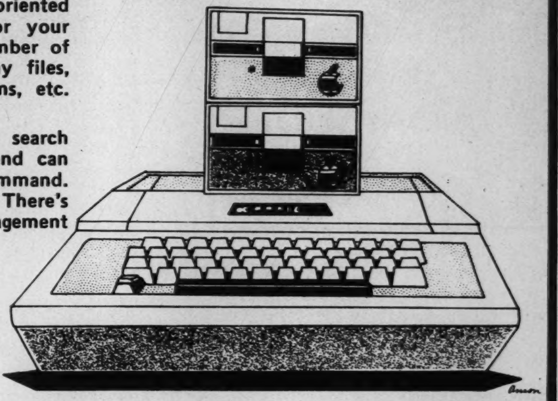

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3. **RENUMBERING ROUTINE.** With a single keystroke your program is renumbered. Starting line number and increment may be changed.
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5. **PRINTER DRIVER.** Simply hit CTRL P to direct output to Centronics printer.
6. **RIVIVAL ROUTINE.** If NEW or CLOAD are typed, or RESET is hit by mistake, your program may be recovered. This is a safety device.

OTHER FEATURES

- RUNSTOP stops execution until any other key is hit.
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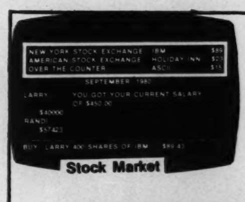

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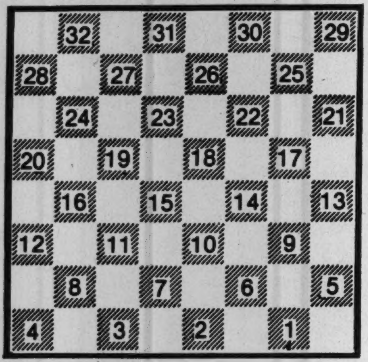
non-linear terms in the function, as will be mentioned later. In the following list the board notation is as used in the draughts (checkers) literature.



ADV (Advancement)

The parameter is credited with 1 for each passive man in the 5th and 6th rows (counting in passive's direction) and debited with 1 for each passive man in the 3rd and 4th rows.

APEX (Apex)

The parameter is debited with 1 if there are no kings on the board, if either square 7 or 26 is occupied by an active man, and if neither of these squares is occupied by a passive man.

BACK (Back Row Bridge)

The parameter is credited with 1 if there are no active kings on the board and if the two bridge squares (1 and 3, or 30 and 32) in the back row are occupied by passive pieces.

CENT (Center Control I)

The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 which is occupied by a passive man.

CNTR (Central Control II)

The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 that is either currently occupied by an active piece or to which an active piece can move.

CORN (Double-Corner Credit)

The parameter is credited with 1 if the material credit value for the active side is 6 or less, if the passive side is ahead in material credit, and if the active side can move into one of the double-corner squares.

CRAMP (Cramp)

The parameter is credited with 2 if the passive side occupies the cramping square (13 for Black, and 20 for White) and at least one other nearby square (9 or 14 for Black, and 19 or 20 for White), while certain squares (17, 21, 22 and 25 are Black, and 8, 11, 12 and 16 for White) are all occupied by the active side.

DENY (Denial of Occupancy)

The parameter is credited with 1 for each square defined in MOB if on the next move a piece occupying this square could be captured without an exchange.

DIA (Double Diagonal File)

The parameter is credited with 1 for each passive piece located in the diagonal files terminating in the double-corner squares.

DIAV (Diagonal Moment Value)

The parameter is credited with 1/2 for each passive piece located on squares 2 removed from the double-corner diagonal files, with 1 for each passive piece located on squares 1 removed from the double-corner files and with 3/2 for each passive piece in the double-corner files.

DYKE (Dyke)

The parameter is credited with 1 for each string of passive pieces that occupy three adjacent diagonal squares.

EXCH (Exchange)

The parameter is credited with 1 for each square to which the active side may advance a piece and, in so doing, force an exchange.

EXPOS (Exposure)

The parameter is credited with 1 for each passive piece that is flanked along one or the other diagonal by two empty squares.

FORK (Threat of Fork)

The parameter is credited with 1 for each situation in which passive pieces occupy two adjacent squares in one row and in which there are three empty squares so disposed that the active side could, by occupying one of them, threaten a sure capture of one or the other of the two pieces.

GAP (Gap)

The parameter is credited with 1 for each single empty square that separates two passive pieces along a diagonal, or that separates a passive piece from the edge of the board.

GUARD (Back Row Control)

The parameter is credited with 1 if there are no active kings and if either the Bridge or the Triangle of Oreo is occupied by passive pieces.

HOLE (Hole)

The parameter is credited with 1 for each empty square that is surrounded by three or more passive pieces.

KCENT (King Center Control)

The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 which is occupied by a passive king.

MOB (Total Mobility)

The parameter is credited with 1 for each square to which the active side could move one or more pieces in the normal fashion, disregarding the fact that jump moves may or may not be available.

MOBIL (Undenied Mobility)

The parameter is credited with the difference between MOB and DENY.

MOVE (Move)

The parameter is credited with 1 if pieces are even with a total piece count (2 for men, and 3 for kings) of less than 24, and if an odd number of pieces are in the move system, defined as those vertical files starting with squares 1, 2, 3 and 4.

NODE (Node)

The parameter is credited with 1 for each passive piece that is surrounded by at least three empty squares.

OREO (Triangle of Oreo)

The parameter is credited with 1 if there are no passive kings and if the Triangle of Oreo (squares 2, 3 and 7 for Black, and squares 26, 30 and 31 for White) is occupied by passive pieces.

POLE (Pole)

The parameter is credited with 1 for each passive man that is completely surrounded by empty squares.

RECAP (Recapture)

This parameter is identical with Exchange, as defined above. (It was introduced to test the effects produced by the random times at which parameters are introduced and deleted from the evaluation polynomial.)

THRET (Threat)

The parameter is credited with 1 for each square to which an active piece may be moved and in so doing threaten the capture of a passive piece on a subsequent move.

Different sets of weightings were tried in the evaluation function and an initial set was chosen by playing through a series of checker games from a book and computing the correlation coefficient of the moves chosen by the program and those chosen by the original (human) player.

Rote Learning

The most elementary type of learning worth programming is the storing of a large number of game positions together with their scores as determined by the evaluation function. Samuel pointed out that if a score for a position was arrived at as a result of a 3-ply search, the next time this position is encountered as a terminal node in the tree (say at depth 3) the evaluation of the root position will be made on the basis of a search which has, in one variation, been examined to a depth of 6-ply. In this manner a program with a large storage capability could learn to play a game such as checkers rather well. The problem facing personal computer users is clearly one of space, and without a floppy disk system the task will be impossible for any moderately interesting game. Even with a floppy, games such as checkers will very soon use up all available memory.

Move-Phase Tables

Another method of learning, described in 1974 by Arnold Griffith, is quite unusual. Griffith discovered that in each particular phase of the game a certain move would, fairly consistently, either be a good move or a bad move. This is an oversimplification of his thesis, but it will suffice for the purpose of this article.

Griffith analyzed a number of games from draughts books. Whenever an expert player made a move, Griffith noted the move and defined the position arising after that move as a "strong" position. A position which would have arisen after an alternative move was assumed to be less desirable, and hence termed a "weak" position. He then tabulated all the possible forward moves, of which there are 49, and for each forward move he noted the the proportion of occasions in which this move led to a strong position in each phase of the game (1st ten moves, 2nd ten, 3rd ten, 4th ten, 5th ten and move 50 onwards). The first rows of his table looked like this:

MOVE	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6
1-5	0.07	0.09	0.12	0.06	0.05	0.05
1-6	0.11	0.18	0.15	0.06	0.07	0.02
etc.						

When the program came to evaluate a move it could simply look up the table entry corresponding to the particular move and the appropriate phase of the game. One way of utilizing such a method would be to employ Michie's probabilistic approach described last month, since this would provide a more global view of whether a particular path in the tree was heading in a desirable direction.

I must confess that I find Griffith's method somewhat curious, but it appears to work to a certain extent in draughts, and presumably the same will be true in other games which (a) have a fairly restricted move set, and (b) have a dependence relationship between the various phases of the game and the moves themselves. In chess, for example, the move of the king towards the center of the board is usually very undesirable until the endgame is reached, but the game is so complex that very few rules of this type could be used for phase-tables, and the number of possible chess moves is so vast that the whole approach would be useless. I would be very interested to hear from any reader who successfully applies the phase-table method to a game playing program.

Monthly Tasks

In previous articles I have set a monthly task to test the readers' understanding of particular principles in the programming of computer games. Since this month's article heralds a new phase in my series, in which I shall be concentrating on specific games, I will not be setting any more tasks for the reader. I hope that some of you will write successful game playing programs, and that you will write to me with any interesting ideas or discoveries. ☐

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Chuck Carpenter

Correspondence is always welcome and a response will be made to those accompanied by a SASE. Send your letters to: Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

Reports from NCC are indicating lots of new products will be available for our Apple computers. My first new acquisition will be the Softcard from Microsoft. With this card I will be able to have a version of Basic that is more suitable for the kind of programming I like to do. There will be several other languages available for the Softcard system too. Check the ads in the magazines and at your computer store if you're interested. I'll be watching the ads and computer stores for any other new items, too. I have one slot left once I get Softcard, and will be looking for something to fill it. No, I'm not getting an Apple III. After lots of thinking on the subject, I decided that I would not be able to do many of the things that I like to do. With the Apple III, a lot of flexibility will be lost. With all the products being offered for the Apple II, and all the things you can do with the system on your own, it seemed foolish to me to start all over again. And, now that Mountain Hardware has announced an expander box, you can add 8 more slots to your Apple II. The next several months should bring us many interesting Apple II projects. I, for one, will be trying to check out each one.

Listings 1 and 2 are programs to turn your catalog listing into a menu. By including these programs in your HELLO program, you will see the catalog listed on the screen and then, as if by magic, changed to a menu. You can then press a corresponding key and RUN, LOAD, UNLOCK, or LOCK any file listed. Listing 1 is in Applesoft, and the selection options are displayed in billboard fashion. The Integer version in Listing 2 will not appear to be doing anything until you press one of the selection keys. Then you either RUN a program or do one of the other functions. If you have both Integer and Applesoft, you can use the technique of putting the Applesoft version in the HELLO program and the Integer version in a program called Applesoft. The procedure for doing this was described in last month's column. There is a limitation. You can only have up to 23 catalog entries showing on the screen at a time. If you have more than 23, only the last 23 will be included in the menu. These programs were written by Bob Sander-Cederlof for our local newsletter. I usually don't like to bother with gadget programs but these are quite useful. Seemed like something that you might like to have.

Lemonade Music

In the March 1980 column, I included a program for playing "music" with the Apple. The music-playing routine is a machine-language program from the red Apple II Reference Manual. This same music routine is used in the "Lemonade Stand" program being shipped with the newer Apples. I was able to find a copy on the master diskette of a friend's new machine. Why am I telling you all of this!?

Charles Kluepfel of New York City has sent along some interesting data relative to that program. The version I have was written in Applesoft and the program POKEs the machine language into page 3 of memory. Charles found this to be done in lines 10000 through 10190 of the Lemonade Stand program. The values for pitch and duration are POKEd into decimal memory locations 768 and 769. Charles has calculated the values to select the pitch. Here is his contribution.

Based on the tone values for "Raindrops Keep Falling on My Head" in line 11550 of "Lemonade Stand" — 152, 152, 152, 144, 152, 171, 192, 152 and the sheet music for that song, a knowledge that A (pitch) is inversely proportional to the frequency and that 12 half-tones make an octave (doubling of frequency), we get Table 1.

Note that 0 serves as 256 as it needs to be decremented 256 times to get back to zero. The formula used is: if x is the number of half-tones lower than C above middle C, use the nearest integer to:

```
128 * 2 ^ (x/12)
```

Also, a value of 1 can be used for pauses, as the note produced is barely audible. To play all of Lemonade Stand's songs, load the program, GOSUB 10000 to POKE the

Table 1. Values for A to be POKEd for Pitch

	Low	Mid	High	High+
F	192	96	48	24
E	203	102	51	25
D#, Eb	215	108	54	27
D	228	114	57	29
C#, Db	242	121	60	30
C	0	128	64	32
B		136	68	34
A#, Bb		144	72	36
A		152	76	38
G#, Ab		161	81	40
G		171	85	43
F#, Gb		181	91	45

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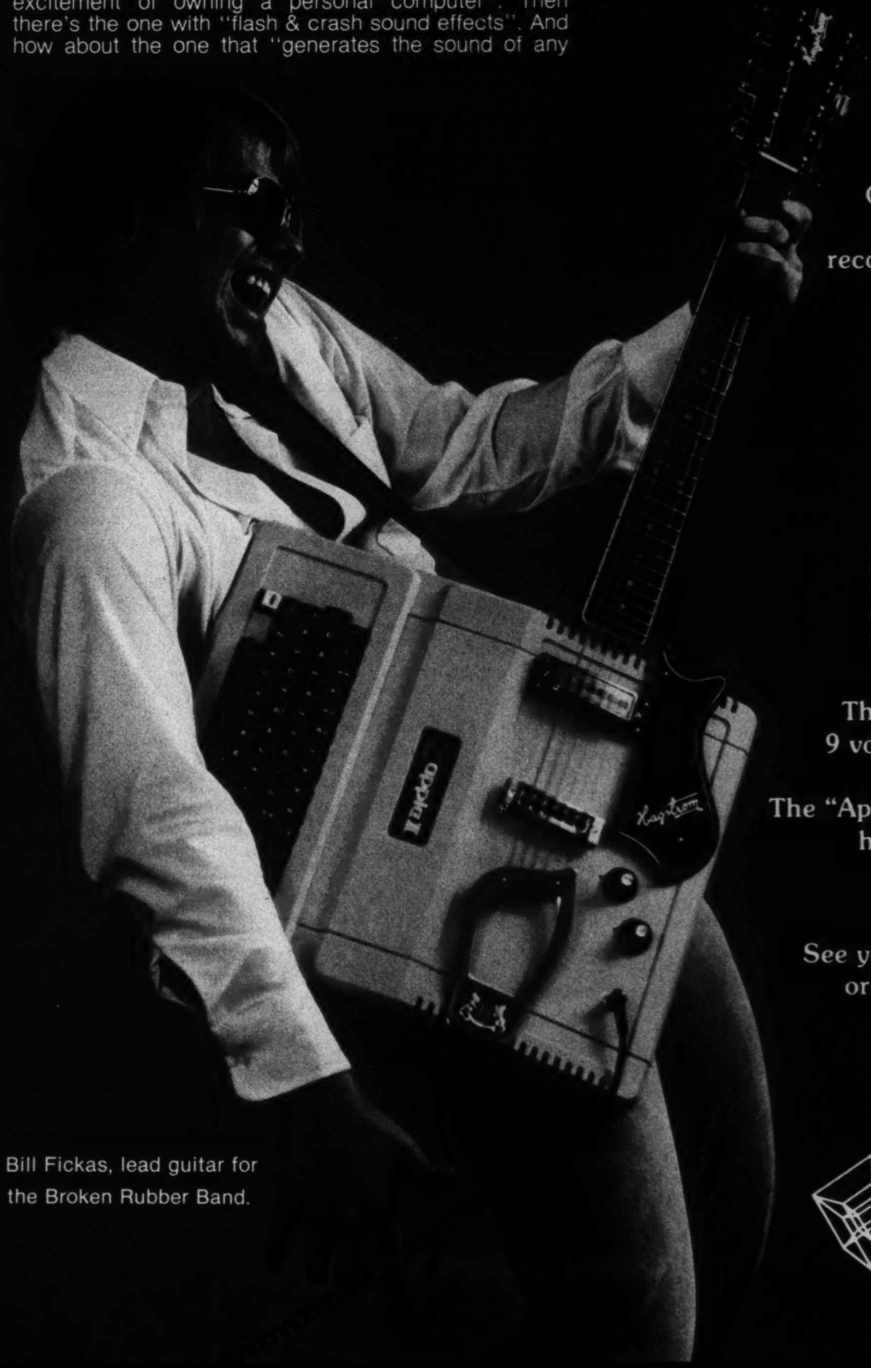

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machine language program, delete line 115200, which has non-musical data, and repeatedly GOSUB 11700. You will get "Yes, We Have No Bananas," some glug, glug, glugs of a glass filling up, "Summertime, and the Living is Easy," "Raindrops Keep Falling on my Head," and "Singin' in the Rain." Charles notes further that if a value of 196 is used to represent middle C then the formula to use is:

```
A = 232.5 / 2 ~ (x/12)
```

All of these calculations will help those of you interested in making your own simple music interpreter. One gentleman, also from New York City, called to let me hear a very nice classical piece done with the tone generating routine. My thanks to both for an interesting application of a useful utility routine. Of course, you should write a program to make the calculations for you. I mean, after all!

Disk-O-Tape

Here's a new program that will allow you to copy your diskettes to cassettes. With Disk-O-Tape, you can copy an entire DOS 3.2 diskette to inexpensive cassettes. Up to 4 diskettes can be stored on both sides of a 60 minute tape. Considering the cost of disks, you can save the cost of several disks you now have tied up as archive or back-up storage. The program is designed to let you save a diskette to tape and, as desired, restore the contents back to an initialized diskette. Here are some of Disk-O-Tapes features:

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Applesoft Revealed

Analyzing how an Applesoft program is constructed in memory has several benefits. One is to append a program. Another might be to make special changes to certain memory locations. A third could be to include a machine language program in with your Basic program. Once you know how to directly modify a program in memory, your imagination can do the rest.

In the following discussion, all memory locations and data will be in hexadecimal. This can be confusing if you usually work with decimal numbers. And the 'Tokens' we will be talking about are decimal values in the Applesoft manual. When working directly with values in memory, only hexadecimal numbers are used. So, if you're not comfortable with HEX numbers, now's the time. (You should be able to easily convert back and forth because PEEKs and POKEs use decimal values.)

Clearing Memory

On page 140 in the appendix of the Applesoft manual, you can find that programs start at memory location 801 for the ROM version (3001 for the tape version). The page zero pointer to this location is in memory locations 67-68. To make sure we can know that our inputs are easily identified, let's put an easy-to-recognize character in several memory locations. The following sequence will let us do that:

```
]CALL-151

*800:FF

*801<800.87FM

*800.81F

0800- FF FF FF FF FF FF FF FF
0808- FF FF FF FF FF FF FF FF
0810- FF FF FF FF FF FF FF FF
0818- FF FF FF FF FF FF FF FF
```

The character 'F' is not likely to be found in pairs in this test, so I used it. This is what happened: From Applesoft, a CALL-151 is made to get to the monitor. Next, the value FF is loaded into memory location 800. The next step uses the monitor move commands to fill a range of memory with the value loaded into location 800. A memory dump of the program area we will be using is shown in the last step. I am showing less memory than the move command used because I already know how big my test program is. Now, press the <CTRL>B key sequence to get back to Applesoft.

A Test Program

Now let's write a short program and see what happens to the program space. To keep things easy to understand, only low line numbers and simple commands will be used. The following sequence, using a three line program, will do the job:

```
1  REM
2 X = 1
3  PRINT

]CALL-151

*69.6A

0069- 17 08
*
*800.81F

0800- 00 07 08 01 00 B2 00 0F
0808- 08 02 00 58 D0 31 00 15
0810- 08 03 00 BA 00 00 00 FF
0818- FF FF FF FF FF FF FF FF
```

After typing in the short program, we again make the CALL to the monitor. This time, from page 140, the memory locations in page zero containing the address of the end of the program are examined. A memory dump of locations 69 and 6A show us that the end of the program is at memory location 0817. It's customary to display the low address byte first and the high address byte last (adds to the challenge of learning new things). And, once more, we make a memory dump of the range where we expect the program to be.

Interpretation

And there it is. By examining the data in the memory dump, the contents of the program will be revealed. As you can see, the Applesoft interpreter replaced most of the Fs with program data. The first byte at address 800 is always 00 and is not part of the program. The next two bytes at address 801 & 802 contain the address of the next line at 0807. Next, bytes at addresses 803 & 804 are the number of the first line, 0001. Following the line number pair, the next byte represents the token for the REM in line 1. Tokens are used to represent keywords and commands. This way, only one byte is needed to represent commands that may use several letters. A complete list of tokens used in Applesoft can be found on page 121 in the Applesoft manual. You may want to convert these decimal values to hexadecimal for easy reference.

Following the REM token is the end of the line indicator. This is always 00. At location 0807 and 0808 are the bytes for the address of the next line, 080F. As you recall, the first line started with the byte pair for the address of this line which started at 0807 (whew). Addresses 0809 and 080A are the line number of this line, 2. The bytes 58, D0, and 31 represent the ASCII value for X, the token for =, and the ASCII value for 1. The end of line 00 byte is at 080E. Note that a table of ASCII values can be found on pages 138 and 139 in your Applesoft manual. You will find that a HEX 80 has to be added to the characters so the output will be in normal video when the value is printed on the screen.

The last line starts at addresses 080F and 0810. These bytes point to the next line address at 0815. In this case, the bytes at this address are the end of program bytes, 0000. At address 0811 and 0812 are the line number bytes, followed by the token for PRINT, then the end of line byte, 00. As mentioned before, the end of program bytes 0000 are at addresses 0815 and 0816. At the beginning, we said the end of the program was at 0817. This we determined by listing the contents of 69 and 6A. Actually, this is the address of the beginning of the variables table. Now, press the <CTRL>C combination to get back to Applesoft. Make sure it's C or the

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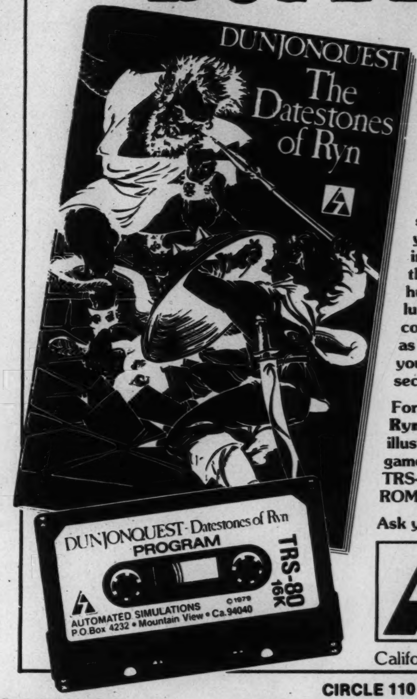

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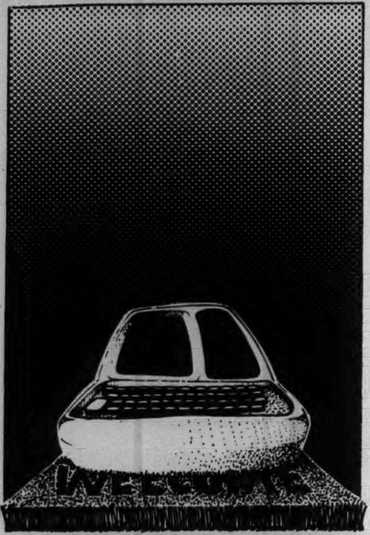

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program will be wiped out. (Can you figure out how to restore the pointer to the end of the program yet?)

Variables Appear!

Because we have not run the program, the variables table has not been placed in memory. This is an important thing to remember. If you are going to make any changes to a program, don't run it until you have made all the changes you intend to make. Now, let's run the program:

```
]LIST

1  REM
2 X = 1
3  PRINT

]RUN


]CALL-151

*800.81F

0800- 00 07 08 01 00 B2 00 0F
0808- 08 02 00 58 D0 31 00 15
0810- 08 03 00 BA 00 00 00 58
0818- 00 81 00 00 00 00 FF FF
```

Now go back to the monitor once again. Notice that the interpreter has now placed the variable table at the end of the program. Only two of the F's are left.

Signifying What?

Suppose you wanted to change line number 3 to something else. By changing the values in memory locations 0811 and 0812 to FF you would change line number 3 to 65535. Or, something that makes using machine language simpler, tack the code on the end of your Basic program.

- First, write the Basic program
- Second, determine the address of program end
- Next, load the program into memory
- Start it at the address of program end
- Remember this is at the location indicated by 69 & 6A
- Change the contents of 69 and 6A to the end of machine language
- Now go back to Basic and save the program.

Remember, don't run the program until after you have saved it.

When the machine language program is written, make a note of its length. Also, be sure it is written to run in the memory space where it will be included in your Basic program. Make sure to add the end of program 0000 bytes to your program too. There! Now doesn't that start your imagination humming? ☐

Listing 1
Applesoft Cataloger

```
]LIST

100  TEXT : HOME :D$ =  CHR$ (4): PRINT D$"CATALOG":B =  PEEK (
     37) - 2: IF B > 22 THEN B = 22
110 T = 0:CH = 4: FOR CV = 0 TO 23: GOSUB 1000: IF C <  > 160 THEN
      POKE P - 1,219: POKE P,T + 193: POKE P + 1,221:T = T + 1:
     S = CV
120  NEXT CV: VTAB 24:A$ = "TYPE LETTER TO RUN, OR LOAD=1 LOCK=
     2 UNLOCK=3 DELETE=4 EXIT=5...."
130 B$ = "RUN": HTAB 1: PRINT  LEFT$ (A$,39);:A$ =  MID$ (A$,2)
      +  LEFT$ (A$,1):K =  PEEK ( - 16384): IF K < 128 THEN  FOR
     K = 1 TO 75: NEXT K:K =  FRE (0): GOTO 130
140  POKE  - 16368,0:K = K - 176: IF K < 1 OR K > 5 THEN 300
200  HTAB 1: CALL  - 868: IF K = 5 THEN  END
210  PRINT " PRESS 'LETTER' YOU WISH TO ";: IF K = 1 THEN B$ =
     "LOAD"
220  IF K = 2 THEN B$ = "LOCK"
230  IF K = 3 THEN B$ = "UNLOCK"
240  IF K = 4 THEN B$ = "DELETE": FLASH
250  PRINT B$;: CALL  - 198: NORMAL : GET K$:K =  ASC (K$) - 48

300  IF K < 17 OR K > T + 16 THEN 130
310 CH = 1:CV = S - T + K - 16: GOSUB 1000: IF C = 194 AND (B$ =
     "RUN" OR B$ = "LOAD") THEN B$ = "B" + B$
320  FOR CH = 6 TO 39: GOSUB 1000:B$ = B$ +  CHR$ (C): NEXT CH:
      HTAB 1: CALL  - 868: PRINT B$: PRINT D$;B$: GOTO 100
1000 C1 =  INT (CV / 8):C2 = CV - C1 * 8:P = 1024 + 128 * C2 +
     40 * C1 + CH:C =  PEEK (P): RETURN
```

Listing 2
Integer Cataloger

```
>LIST
   0 LOMEM:2048: POKE -16298,0: POKE -16300,0: TEXT
  10 DIM A$(40),B$(6):D$="": PRINT D$;"NOMONCIO": CALL -936: PRINT
     D$;"CATALOG"
  20 I=I+2: IF SCRN(4,I-1)=10 THEN 20:P=I/2
  30 VTAB P+Q: TAB 4: PRINT "[ ]":Q=Q+1:R=I+Q*2-2: COLOR=(Q+128
     )/16: PLOT 4,R-1: COLOR=(Q+128) MOD 16: PLOT 4,R-2
  40 IF SCRN(4,R+1)#10 THEN 30:T= PEEK (37): PRINT "RUN ?  LOCK=1 U
     NLOCK=2 DELETE=3 EXIT=4";:B$="RUN"
  50 K= PEEK (-16384): IF K>176 AND K<180 THEN 60: IF K=180 OR
     K>192 AND K<193+Q THEN 80: GOTO 50
  60 IF K=177 THEN B$="LOCK": IF K=178 THEN B$="UNLOCK": IF K=
     179 THEN B$="DELETE": VTAB T+1: TAB 1: CALL -868
  70 PRINT " PRESS "LETTER" YOU WISH TO ";: IF K=179 THEN POKE
     50,127: PRINT B$;: CALL -198
  80 POKE 50,255: POKE -16368,0: IF K>176 AND K<180 THEN 50: IF
     K=180 THEN END :I=I+(K-193)*2-2: IF SCRN(1,I)=2 AND B$="RUN"
      THEN B$="BRUN"
  90 FOR X=7 TO 39: POKE 2046+X, SCRN(X,I)+ SCRN(X,I+1)*16: NEXT
     X: PRINT : PRINT D$;B$;A$: GOTO 0
```

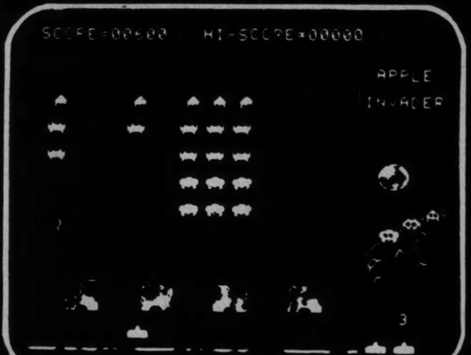
SPACE WAR

FLOOOOOM
WHOOOMPH
KROW

You're in command in **SPACE WAR!** Destroy your opponent's ship by forcing him to collide with the sun or to explode upon re-entry from hyperspace . . . or challenge him face to face with missile fire. You're in command of the speed and direction of your ship. You control the timing of your missiles. You select the game mode from five options, including Reverse Gravity, and the battle begins . . . Accelerate to place your shots--and escape into hyperspace before your opponent comes within range. But be wary, he (or she!) may circle out of sight and reappear on the opposite side of the galaxy! (This is the classic MIT game redesigned especially for the Apple.)

and SUPER INVASION

- **Super Invasion** is the original invasion game, with the original moon creatures and faster action than any other invasion game.
- Features superb high resolution graphics, nail-biting tension and hilarious antics by the moon creatures!
- Self-running "attract mode" of operation for easy learning and demonstrating of the game.
- As good in every way as the famous Invaders arcade game.
- High speed action ! • Sound effects!
- Runs on the Apple II and the Apple II Plus



Fifty-five aliens advance and shower you with lethal writhing electric worms. As you pick off the aliens, one-by-one, they quicken their descent. They whiz across the screen wearing away your parapets, your only defense, coming closer and closer to your level. **Super Invasion** is the **original** invasion game with the original moon creatures and faster action than any other invasion game on the market.

Super Invasion is available for only $19.95 on cassette (CS-4006) for a 32K Apple II. **Space War** is $14.95 on cassette (CS-4009) for a 16K Apple II. **Space War** and **Super Invasion** are on one disk (CS-4508) for a 48K Apple II for only $29.95.

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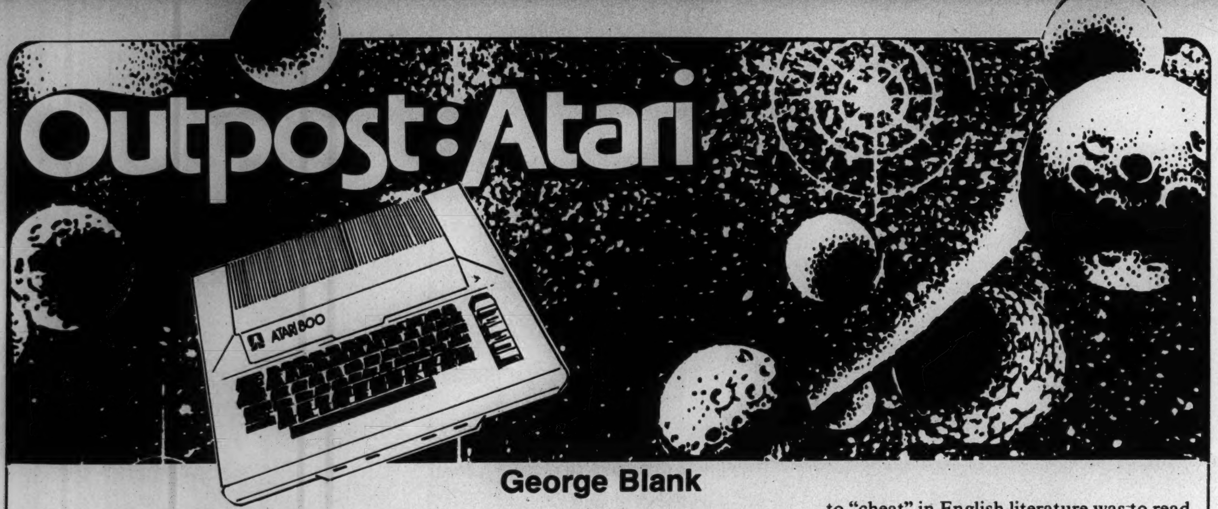
CIRCLE 300 ON READER SERVICE CARD

Outpost: Atari



George Blank

Learning at Atari Academy

Atari takes the educational market seriously, with a wide selection of educational courses. Among the courses announced are:

- U.S. History (Secondary Level)
- U.S. Government (Secondary)
- Supervisory Skills (Adult)
- World History (Secondary)
- Basic Sociology (College)
- Counseling Procedures (College)
- Principles of Accounting (College)
- Physics (College)
- Great Classics (Elementary/Secondary)
- Business Communications (Adult)
- Basic Psychology (College)
- Effective Writing (College)
- Principles of Economics (Secondary)
- Spelling (Adult)
- Basic Electricity (Technical)
- Basic Algebra (Secondary)

The ranges indicated are only general, based upon Atari's advertising and my own initial reactions. For example, Atari claims a level of elementary, secondary and adult/college for the U.S. Government course. My own reaction to it is that, while it is certainly understandable by a reasonably intelligent fourth grader and helpful to an adult, it is most reasonably aimed at high school level.

Each course consists of four cassette tapes, which contain both digital and audio information. You need the educational system master cartridge, supplied with the Atari 800, $30 extra for the Atari 400, to use the course material, as the master cartridge allows the processing of the audio and digital tracks at the same time.

The instructions for each course are quite simple. You put the educational system master cartridge in the computer and turn it on, put the cassette in the recorder and press play, press the start button on the computer, and when the computer asks a question, answer by pressing 1, 2 or 3. The instructions, which are the same four-page brochure for all the courses, also list a brief outline of each course. I would like to see more explanatory material, perhaps a booklet with supplementary readings, with each course.

Each lesson consists of text which is displayed on the screen accompanied by narration, essentially the same as the text. At regular intervals throughout the lesson, questions are asked, two or three answers are displayed on the screen, and the tape recorder stops. The student answers the question by typing 1 to select the answer on the left, 2 for the answer in the middle of the screen, or 3 for the answer on the right. If the wrong answer is selected, the computer beeps to indicate the need to try again. When the right answer is selected, the tape starts again and continues, frequently with a comment such as "That is correct," "Yes," or "Right." Because the tape recorder is starting, the first word is often slurred.

The material is well written and well narrated, and occasional limited graphics break up the text. The effect is one of a talking book that stops to ask questions and waits for the right answer before continuing. Each lesson lasts about half an hour.

I did not review the whole series, but tried selected lessons from several of them. Here is a summary of my impressions.

In the Great Classics series, each tape contains lessons on two books. The books are *Julius Caesar* and *Macbeth* by Shakespeare, *Ivanhoe, Treasure Island, Mutiny on the Bounty, A Tale of Two Cities, Robinson Crusoe, Last of the Mohicans, Moby Dick, David Copperfield, Don Quixote, The War of the Worlds, The Three Musketeers, 20,000 Leagues Under the Sea, The Red Badge of Courage,* and *William Tell.* In each case, the basic story is told in half an hour, along with questions to help emphasize turning points and key ideas. Important quotes are included in the lesson.

I can remember as a child that the way to "cheat" in English literature was to read the Classic comic book for the current book to be read. As a confirmed bookaholic from the age of six, I was never tempted to avoid the book by such a summary. In the case of *Treasure Island,* I read the book, saw the movie, read the comic book, and studied the Atari lesson. The book was by far the most satisfying experience, and I dwelt for hours over the Wyeth illustrations. The movie was less satisfying, and the comic much less satisfying. The lesson was work, not joy, although it did emphasize the main features of the course. My impression of the course is that it is equivalent to an unsophisticated imitation of the Cliff's notes series.

I did complete the Supervisory Skills course, more out of duty than enthusiasm, and found that the lessons seem pedantic after a few hours of exposure. The material was reasonably well organized, informative, and useful, but not stimulating. Philosophically, those who believe that learning ought to be work and not play should feel satisfied with the lessons.

The educational series uses a different cassette loading format, and it is not as reliable as the standard format. A number of times during the lessons, the computer lost track of the digital track, and continued on with the audio lessons without writing to the screen. Usually I could restart the digital by resetting the computer and hitting the start button again.

These courses will probably prove to be an excellent resource for pupils who have difficulty reading, summarizing the core content of the material and providing drill right afterwards. For those with good reading skills, a good book on the subject would probably be a better investment. I would much rather see a good historical simulation, such as a game requiring you to play the part of a ship captain in the rum, molasses, and slave trade of the 1700s, than have someone tell me the story and ask me questions afterwards.

George Blank, Foster Road, Milford, NH 03055.

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ANA1* (ANALYSIS 1) is a set of BASIC Programs which enables the user to perform analyses on any time series data. From 26 to 260 data points (5 years weekly, 1 year daily) can be plotted on the entire screen in one of 5 colors using Apples' High Resolution capabilities. The data can be transformed into different colored graphic representations called transforms. They are: user specified moving averages; a least squares linear fit (best straight line); filters for time, magnitude, or percentage changes; and user created relationships between the data, a transform, or a constant using +,-,x,/ operators. Colored lines can be drawn between graphic points. Graphic data values or their weekly dates of occurrence can be displayed in text on the screen. Any graph or text can be outputted to a users printer. The Grid Scale is automatically set to the range of the graphs or can be user changed. As many colored graphs as wanted can be plotted on the screen and cleared at any time. The user can code routines to operate on the data/transform data or create his own disk file data base. ANA1 commands can be used with his routines or data base. An Update program allows the user to easily update his file with current data. Data Base included: DJI weekly average, 1897 to date.

The ANA1 two letter user commands are: CA = Calculate, no graph. CG = Clear Graphs, leave Grids. CK = Checking out program, known data. CO = Color of next graph (red, green, violet, white, blue). CS = Clear Screen. DL = Draw Line between points. FI = Filter data for time, magnitude, or percent change. FU = Data, transform, or constant Function with +,-,x,/ operator. GD = Graphic mode, display all Graph Data on screen. GR = Graph data to screen. GS = Set Grid Scale. HE = Help, summary of any commands usage. LD = Load Data from disk file from inputted date to memory. LG = Leave Graphs, automatic Grid rescaling. LO = Look, select a range of the LD data and GR; All commands can now be used on this range. LS =Least squares linear fit of the data. MA = Moving Average of the data. NS = No Scale, next graph on screen does not use Grid Scale. NT = No Trace. PR = User implimented Printer routine. TD = Text mode, display Text Data on screen. TI = Weekly time number to date or vice versa. TR = Trace. TS = Text Stop for number of lines outputted to screen when in TD. U1/U2 = User 1/2 implimented routines. VD = Values of Data outputted in text. VG = Values of Grid: low/high/delta. VT = Values of Transform outputted in text.

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CIRCLE 128 ON READER SERVICE CARD

The ATARI® Tutorial COMPUTER Calligraphy?

Well, not really! But with the FONTEDIT program in **IRIDIS #2** you can design your own character sets for the **ATARI**. For example, you can create a Russian alphabet, or APL characters, or even special-purpose graphics symbols. These special *fonts* can be saved on disk or tape for later use by your own Basic programs. FONTEDIT is a friendly, easy-to-use program: just grab a joystick and start designing. With our KNOTWORK program, you can design patterns of *Celtic interlace*, (a technique used by 7th century Irish monks to illuminate manuscripts). After you have produced a pretty pattern on the screen of your **ATARI**, you can save it on disk or tape.

Best of all, **IRIDIS #2** comes with a **48-page** *User's Guide*, which gives clear instructions on how to use the programs. The *guide* also provides detailed, line-by-line descriptions of how the programs work. **IRIDIS** programs are written to be studied as well as used.) *Hacker's Delight* presents useful explanations of many of the important PEEK and POKE locations in your **ATARI**.

The **IRIDIS #2** tutorial for the **ATARI** is available now from your local **ATARI** dealer. You get the *User's Guide* and a cassette (or disk) with FONTEDIT, KNOTWORK, and a routine to allow your program to load a custom font.

ATARI is a trademark of **ATARI, Inc.**

To: **The Code Works,** Box 550, Goleta, CA 93017
Please send me **IRIDIS #2** for my **ATARI** immediately.
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Programs for your **ATARI**™

CIRCLE 217 ON READER SERVICE CARD

Atari, cont'd...

Programming Feature - Real Time Clock

A real time clock can be very handy as a programmer's tool. Many clock functions can be done with timing loops, but the computer can only do one thing at a time, and it is very touchy programming to use timing loops with complex tasks. If you own an Apple, you can buy a real time clock for $200. If you own a TRS-80, you can spend $300 for the expansion interface and get one. If you are handy with electronics, you can probably connect a digital watch to almost any computer. However, if you own an Atari, keep your wallet in your pocket and your soldering iron on the workbench, for the Atari has not one, but five built-in timers.

All you need for an Atari real-time clock is software to use these timers. The timers are a two-byte serial input/output timer located at memory location 536, three two-byte countdown timers at locations 538, 540, and 542, and a three-byte video-display frame counter at memory location 18. All values given are decimal. The countdown timers are preempted by some interrupt actions, so the other two are best for keeping accurate time. The easiest to use is the frame counter, which also has the advantage of an extra byte of information.

The frame counter is organized with the most significant byte at location 18 and the least significant byte in location 20. Location 20 is updated 60 times each second, location 19 every time location 20 reaches a count of 256, and location 18 every time location 19 reaches a count of 256.

Thus each count in location 20 represents 1/60th of a second, location 19 represents 256/60ths of a second, and location 18, 65536/60ths of a second. To use the clock, we need merely multiply the contents of 18 by 65536, 19 by 256, and the contents of 20, add the contents of 20, and then divide the resulting count into seconds, minutes, hours or other units of time.

If we want a timer, we can POKE zeroes into the three locations to start the count. If we want a clock, simply calculate the number of sixtieths of a second since midnight and POKE that number into the three locations. Here is a short program that uses the frame counter for a timer:

```
100 POKE 20,0 : POKE 19,0 : POKE
    18,0
110 GRAPHICS 17
120 A=PEEK(20) : B=PEEK(19) :
    C=PEEK(18)
130 TIME = (A + B*256 + C*65536) /
140 POSITION 0,6
150 PRINT#6;INT(TIME);" SECONDS"
160 GOTO 120
```

Notes:

GRAPHICS 17 is the same as GRAPHICS 1 (20 rows of 20 double wide text characters) except that the split-screen format is overridden.

POSITION 0,6 prepares to print at the start of line 6.

PRINT #6 tells the computer to print to the graphics window instead of the text window.

If you want to be careful about accuracy, POKE location 20 first to time an event that takes place before the POKE, and last for an event that follows the POKE. Then add or subtract 60ths of a second to A in line 120 to adjust for timing inaccuracy. For example, if it took one third of a second to calculate and print the result after our PEEK statement in line 120, we could add 20/60ths of a second in this fashion:

```
120 A=PEEK(20) + 20 : ...
```

There is still one serious limitation on accuracy. It is possible that location 18 or 19 could be updated in between PEEKs and throw the calculation off by 18.2 minutes or 4.3 seconds, respectively. If this is a major problem, the solution is to use a USR routine in machine language.

Image Computer Products

We are starting to see companies with experience in consumer marketing offering products for the Atari. One such entrant is Image Computer Products, with an initial offering of six packages that will work in the Atari 400 or 800.

Mind Master is a version of Bagels and the name is reversed to avoid someone else's trademark. The 8K version is for two players. The 16K version allows one to four players, and the computer can be one of the players.

All Star Baseball is for two players. The 16K version uses joy sticks and includes the option of curving the ball back and forth on the pitch, and a graphic fielding routine. Both versions suffer severely from the computer recognizing input from the wrong player. In the 8K version, if either player holds a key down, the other cannot move. This makes it easy to strike a batter out by denying him a chance to swing. In the 16K fielding routine, the computer responds to both joysticks, so the batter can prevent the other from fielding the ball properly. Despite these weaknesses, this is a favorite of my 6-and-7 year-old sons.

Wall Street Challenge is a stock market simulation giving stock with different personalities and charting of the market index. Players buy and sell in an attempt to make the most money. Two players are allowed in the 8K version, and up to eight in the 16K version.

Strategy Pack I contains two games. Roman Checkers is a computer version of the game CBS sells as Othello. If two people play, the computer flips all the counters and keeps count. You can also play against the computer, though it plays a weak game. Frame Up is a strategy number game in which each player in turn selects a number from a grid. One player must select from the same horizontal row that the other player selected from, and the second player must choose from the remaining numbers in the vertical row of the last pick. The computer can play, and is a tough opponent.

The other two packages are Skill Builder I with two number games for children and Strategy Pack II with four variations on moving line games. All programs are written in Basic, and come attractively packaged with an instruction manual. The two Strategy Packs and Skill Builder cost $19.95, while the single games cost $14.95.

Buying Memory

If you are using your computer for anything other than the ROM pack games like Star Raiders or the Educational Series, you will probably find that the 8K of memory in your computer is not enough. Graphics Modes 8, 9, 10, 11, 24, 40, and 56 all use 7900 bytes of memory just for the screen display. You could make room for more program by using mode 2, which only uses 261 bytes, but you can pretty much count on adding memory. I recommend the 16K cartridges as a better buy than the 8K ones. The disk operating system takes up another 10K of memory for disk users.

My prediction is that most cassette system owners will end up with 24K of memory (one additional cartridge) and most disk users with 40K (two additional cartridges). This is important, as people who write programs need to gear their programs to the potential market. People who are currently writing 16K programs will probably lose out to those writing more sophisticated programs for 24K. Of course, the present market is for good 8K programs, but that will not last.

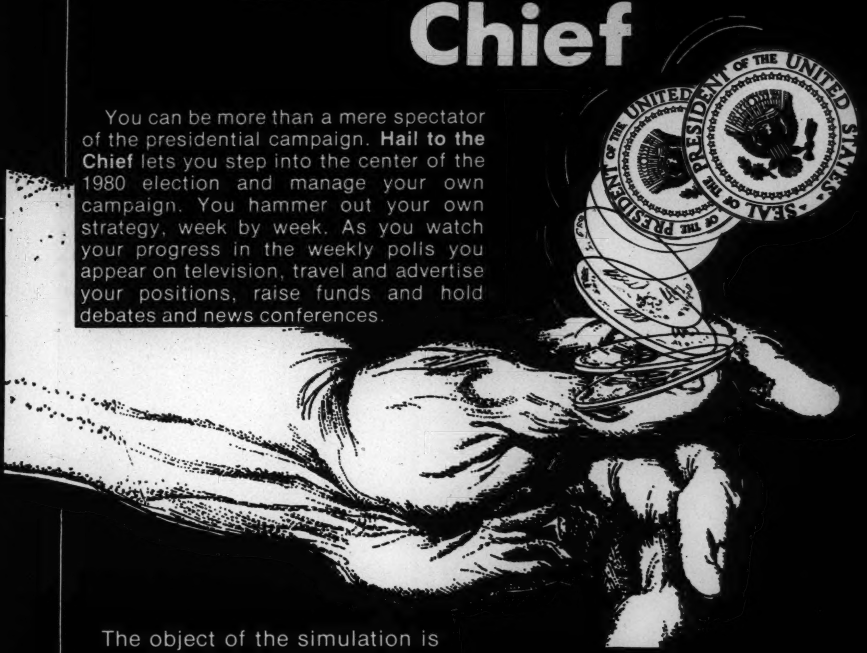
Do NOT put more than 40K of memory in your Atari 800. Not only is it extravagant to discard an 8K module to buy a 16K, it also is a useless task. That last 8K of memory is preempted by the left ROM cartridge, so that you cannot have more than 40K of memory with Basic or the Assembler. In the future, when cartridges are available for the right hand slot, they will preempt another 8K of memory, limiting the user to 32K.

New Englanders Arise!

Any Atari owners in the Boston area who are interested in a User Group are invited to write to me. The Boston Computer Society is forming an Atari User's Group. Just send a postcard or 3 by 5 card with your name, address, and phone number and mention that you are interested. I prefer a card because it is easier to file. □

Hail to the Chief

You can be more than a mere spectator of the presidential campaign. **Hail to the Chief** lets you step into the center of the 1980 election and manage your own campaign. You hammer out your own strategy, week by week. As you watch your progress in the weekly polls you appear on television, travel and advertise your positions, raise funds and hold debates and news conferences.


SEAL OF THE PRESIDENT OF THE UNITED STATES

The object of the simulation is to become president-elect when the final election results are in. Refinements of the simulation such as the influences of incumbency, campaign finance and spending limits are introduced in increasingly complex models. Each model can be played at ten levels of difficulty—a level 10 opponent is tough to beat.

This is a straightfoward simulation, without scenarios of blatent corruption, but temptations to compromise your ideals are still realistic and powerful...

Will you change your positions to capture the financial support of labor of Big Business? Or play down your unpopular positions to capture the votes of a particularly important and sensitive region? As in real life, the presidency can be captured by integrity or guile. Only the candidate knows the price of his, or her, success.

The ten pivotal camgaign issues in **Hail to the Chief** include Energy Policy, Unemployment, Mid-East Policy and Strategic Arms Limitations. Your positions are chosen from a nearly two hundred degree numerical scale which ranges from "Bleeding Heart Liberal" to "Middle-of-the-Road" to "Reactionary". For example, strong conservative and liberal statements on Strategic Arms Limitations are:

Our enemies understand only strength and they have proven that they will not honor any treaty obligation that stands in their path toward world domination.

An uncontrolled arms race is more likely to lead to war then any other policy the U.S. can follow; it is also a waste of our resources and puts too much power in the hands of the military industrial complex.

Hail to the Chief has been used as a teaching aid in Political Science, Computer Science and Voting Behavior courses at the University level since 1976. Its authors are Associate Professors at the Eastern Kentucky University; Phillip W. Brashaer in Mathematics and Richard G. Vance in Political Science. A comprehensive manual, discussion questions and background materials have been prepared by the authors and accompany the fun and educational package. **Hail to the Chief** is available for the TRS-80 level II on a 32K cassette (CS-3205) and a 48K disk (CS-3701), for the Apple II and Apple II Plus on a 48K disk (CS-4704), for the Atari 400 and 800 on a 32K cassette (CS-7201) and for the Atari 800 on a 40K disk (CS-7701). All are $24.95.

Your local computer store should carry Creative Computing Software. If your favorite retailer does not carry the software you need, have him call in your order to 800-631-8112. Or, you can order directly from Creative Computing Software, Dep't. AHGG, P.O. Box 789-M, Morristown, NJ 07960. Include $1.00 for postage and handling. For faster service, call in your bank card order toll free to 800-631-8112.

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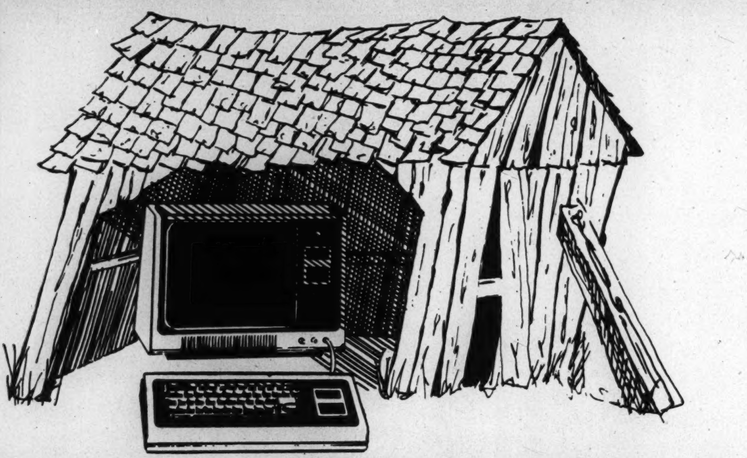
TRS~80 Strings

Stephen B. Gray



For TRS-80 column 22, let's look at what a reader considers as good programming practices, a note on how to disable the BREAK key, Microsoft's Typing Tutor program, a reader's programs that (1) print full error messages and (2) print a 3D plot, a program for playing music on a TRS-80 keyboard in real time without programming, Dick Fuller's RF-III control center, a letter about the Fuller LPRINT/LLIST plug, and Fuller's Scripsit index.

Good Practices

Steve Smith, of Cleveland, Ohio, sent the following after reading the August 1979 TRS-80 column (page 126):

"I would like to make a couple of comments about your graphic random-square generator. A listing of my modified version of this program is enclosed. [See following. —Ed.]

```
5 REMARKABLE SQUARES Program
by Stephen M. Smith, based on a
   suggestion
by Stephen B. Gray in "CREATIVE
   Computing" 8/79
10 DEFINT A-Z: RANDOM: CLS
17 PRINT@17,"* * * *  MAGIC SQUA
RES  * * * *"
20 H=((RND(9)-1)*14)+3: V=((RND(
6)-1)*7)+4
35 FOR K=1 TO RND(RND(26))-1: SE
T(RND(10)+H,RND(5)+V): NEXT
40 FOR K=1 TO RND(RND(26))-1: RE
SET(RND(10)+H,RND(5)+V): NEXT
68 IF INKEY$="" THEN 20 ELSE RUN
70 END
```

"First, good programming practices and conventions are encouraged by good example in published programs, even very short ones. A REMark at the beginning of the program serves to identify its function. The RANDOM statement re-seeds the random-number generator. A DEFINT statement will conserve core requirements, even though there is no visible evidence of this apparent during execution. Elimination of spaces in the program source also reduces memory required, but alas, readability suffers.

"Since the statements SET and RESET accept expressions as parameters, the call to the random-number generator can appear within the SET or RESET statements, obviating the need for separate variables to store these values in. In my modification to the program, the coordinates for the square to be manipulated are calculated first. Then the offset is calculated within the SET or RESET statement call.

"In the programs which illustrate your column, the square to be RESET is figured as an offset from the square which was just SET. You went to lengths to illustrate the different patterns that would result if the offset RESET(s) were calculated in different ways. Another approach is to use the RND function to calculate values for both the SET and RESET functions.

"My modification of the program selects a square on a nine-by-six grid at random, SETs a random number of points (up to 25, weighted toward the lower numbers) whose positions are picked at random, and then RESETs an equally random number of randomly selected points in the same square. The INKEY$ function is used so that the program can be re-initialized. It would be quite simple to modify the program so that the SET and RESET operations would not be constrained to functioning on the same square every time.

"The program that you presented in your column was modified in order to make more use of the random-number generator in the TRS-80 Level-2 Basic. A logical extension for this program would be to randomly decide the size and number of squares internally. However, the human esthetics of this type of pattern is not suited to computer simulation, the availability of random-number generation or not!"

Steve's program is shown above as close as we can get to the original 32-column printout, which was made on a Quick Printer II, and which is too faint to reproduce directly.

The program creates, one by one, small groups of randomly-generated graphics blocks. Each group is up to 10 blocks across and five down. Eventually 54 of these groups are created, nine groups across and six down.

From time to time, a group is written over by a new group. Each group is different. This is similar to my program in the August 1979 issue, displayed at the top of the center column on page 127.

Disabling The BREAK Key

If you're RUNning a program such as Steve's graphics program at a science fair or a computer show, and want to prevent passersby from stopping the program by depressing the BREAK key, just add this:

5 POKE 16396,23

which will disable the BREAK key.

Once this is added, the BREAK key acts like any other key in Steve's program, restarting the display.

To stop the RUN, you have to hit the reset button at the left rear of the keyboard. To re-enable the BREAK key, you don't just delete line 5, because you've disabled the BREAK key internally. You have to change line 5 to read:

5 POKE 16396,20

and once you've run the program with that, you can delete line 5, and the BREAK key will work normally again.

This is a handy trick to use any time you want to make the keyboard totally inactive, to keep wandering fingers from halting a RUN. Just remember how to reactivate it.

Microsoft Typing Tutor

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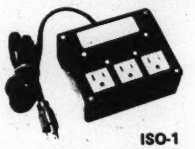

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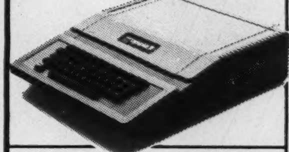

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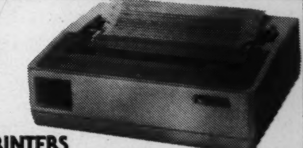

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Image Producers Inc., of Northbrook, IL, which has special software, called Time Response Monitoring (TRM), that is the basis of Typing Tutor.

TRM monitors the keyboard 20 times a second, fast enough to catch the slight pause that occurs when you look at the keys instead of keeping your eyes on the screen.

The program is divided into two parts. The first, Typing Tutor, "is a series of lessons that are continuously adjusted by the computer to help you learn keys you don't know. The program automatically inserts new letters as you gain speed and accuracy," according to the 20-page manual.

The second part, Practice Paragraph, "generates a paragraph drill that lets you type longer passages, then evaluates your skill."

Your first four lesson keys are A, S, D and F. The display shows two groups of four letters, such as

SFDA AFDS

which you type, keeping your eyes on the screen and your fingers over the "home" keys.

When finished, you press ENTER, and another combination of the four letters appears. Each new "lesson," or two groups of four letters, includes keys from the previous lesson that you haven't yet mastered, plus new keys to replace any that the computer puts on the FAST list, up at the top left of the screen.

"As you type each lesson," the manual says, "the program checks to see if you are typing any of the lesson letters fast enough to indicate that you know where they are. When your reaction time on any letter is equivalent to 20 words per minute, that letter is added to the FAST list and a new key is selected for your next lesson." Your speed is monitored on each key *individually*.

After each group of ten lessons, you get a progress report that shows your average accuracy and speed. You then have four choices: ask the computer for a slower response (if you want to cover all the keys more quickly), the same response, or a faster one (to build speed faster), or move on to a Practice Paragraph.

In an ingenious bit of programming, the Practice Paragraph is constructed "based on your response time in the lessons," the screen says. So if you decide to try typing the paragraph after only a couple of lessons, the paragraph includes only a half dozen different letters, in random combinations of words of one to four letters, taken from DATA lines. (The random combinations are better for teaching typing than text that makes sense.)

At the end of the paragraph, an analysis is displayed, including how many keystrokes you missed and on which letters, which keys you were slower on, your percent of accuracy, and your rate in words per minute.

In what may be a unique section, the manual tells what lines to list "if you wish to see how Typing Tutor is teaching you."

The program also teaches numbers and symbols, and is one of the cleverest and most useful I've ever seen. It's even better than Hayden's excellent *Microtyping* program (April 1980, p 132), because it keeps presenting you with letters you don't know, while leaving out those you've learned.

As with Microtyping, the touch-typing skill you learn from Typing Tutor is transferrable to a typewriter, although the symbols will, of course, be a little different.

Typing Tutor is $14.95 at your local computer store or, for an additional $2.50 for postage and handling, from Microsoft Consumer Products, 10800 Northwest Eighth, Suite 819, Bellevue, WA 98004.

ERROR MESSAGE

Jordan M. Corn, of Denville, NJ, sent in two short programs of more than minor interest, for Level II 4K systems.

The first is useful to anyone who has trouble remembering the meanings of BS, TM, LS and most of the rest of those 23 all-too-brief Level II error messages, and that probably includes most of us.

"The first program, ERROR MESSAGE, is a simple utility program that replaces abbreviated error messages with full-length messages. The name of each error is read from data into the ER$ array. When an error occurs, program control branches to statement 10000, where the corresponding message is printed, and the EDIT mode is entered for the 'offending' line.

"Once run, the program will also function if an error occurs in the command mode. If no other program is in memory, ERROR MESSAGE can be enabled simply by typing RUN. If another program *is* in memory, a temporary END statement, say at line 6, can be inserted if desired. The program requires under 1K and uses only the ER$ array."

```
1 DIM ER$(23)
2 FOR X=1 TO 23
3 READ ER$(X)
4 NEXT X
5 ON ERROR GOTO 10000
9999 END
10000 IF ERL=65535 PRINT ER$(ERR/[illegible]+1): RESUME NEXT
10020 PRINT ER$(ERR/2+1);" IN LINE";ERL
10030 EDIT.
10040 DATA NEXT WITHOUT FOR, SYNTAX ERROR
10050 DATA RETURN WITHOUT GOSUB, OUT OF DATA
10060 DATA ILLEGAL FUNCTION CALL, OVERLOAD
10070 DATA OUT OF MEMORY, UNDEFINED LINE NUMBER
10080 DATA SUBSCRIPT OUT OF DIMENSIONS
10090 DATA REDIMENSIONED ARRAY, DIVISION BY ZERO
10110 DATA ILLEGAL DIRECT COMMAND
10120 DATA TYPE MISMATCH ERROR
10130 DATA OUT OF STRING SPACE
10140 DATA STRING TOO LONG
10150 DATA STRING TOO COMPLEX TO HANDLE
10160 DATA CAN'T CONTINUE, NO RESUME
10170 DATA RESUME WITHOUT ERROR
10180 DATA UNPRINTABLE COMMAND, MISSING OPERANG
10190 DATA BAD FIILE DATA, DISK BASIC COMMAND
```

"This program has two apparent bugs which I cannot explain. First, occasionally when the program is enabled, the first error that occurs does not transfer control to line 10000. Second, every other error, for some reason, fills 7 bytes of memory. If too much memory seems to get used, typing CLEAR: RUN will restore memory to its original condition and re-enable the program."

The ERROR MESSAGE program has been altered slightly to fit these narrow columns. It won't work if RESUME NEXT is put on line 10010, so I put it back on line 10000.

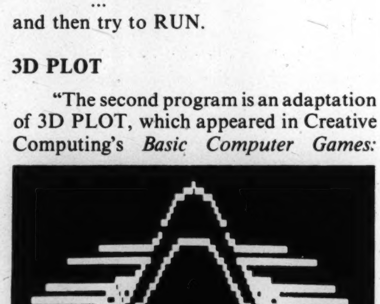
To check out this utility, add lines such as any of these

```
100 NEXT
100 PPRINT Z
100 RETURN
100 GOTO 635
100 PRINT 3/0
...
```

and then try to RUN.

3D PLOT

"The second program is an adaptation of 3D PLOT, which appeared in Creative Computing's *Basic Computer Games:*



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TRS-80, cont'd...

```
100 CLS
110 PRINT TAB(28) "3D PLOT"
120 PRINT
130 PRINT TAB(17) "ORIGINAL AUTHOR: MARK BRAMHALL"
140 PRINT
150 PRINT TAB(20) "MODIFIED FOR THE TRS-80"
160 PRINT: PRINT
170 PRINT "FUNCTIONS ARE DEFINED IN THE FORM"
180 PRINT "        250 F=...FUNCTION IN TERMS OF N..."
190 PRINT: PRINT
200 FOR X=1 TO 1000: NEXT X: CLS
210 FOR X=-30 TO 30 STEP .5: L=0
220 Y1=5*INT(SQR(900-X*X)/5)
230 FOR Y=Y1 TO -Y1 STEP -5
240 N=SQR(X*X+Y*Y)
250 F=30*EXP(-N*N/100)
260 Z=INT(25+F-.7*Y)
270 IF Z<=L THEN 290
280 L=Z: SET((X+30)*2,48-Z*47/61)
290 NEXT Y,X
300 GOTO 300
```

Microcomputer Edition. It has been rewritten to utilize graphics, and the axes have been set so the third dimension rises 'up.'

"The function to be graphed is defined in line 250 is the form

130 F=...FUNCTION IN TERMS OF N...

The author of the original program is Mark Bramhall of DEC. One final note: This program takes several minutes to produce a graph."

In Creative's version (which is also in the TRS-80 edition), the curves are plotted with asterisks. The Microcomputer edition gives some other functions that "work nicely." Modified to fit Corn's version, they include:

250 F=SQR(900.01-N*N)*.9-2
250 F=30-30*SIN(N/18)
250 F=30*EXP(-COS(N/16))-30
(Bessel function — Summerfield's integral)
250 F=25*SIN(N/10)

Both editions note that "3D PLOT will plot the family of curves of any function," and that the function "is plotted as 'rising' out of the x-y plane with x and y inside a circle of radius 30."

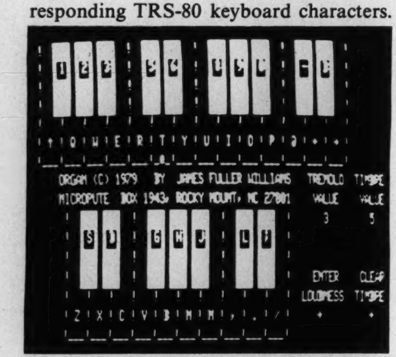
Corn's original program, with only a CLS on line 200, gives no more than a glimpse of the "credits," so a time-delay was added.

ORGAN

With ORGAN, a clever Level II machine-language program for 4K and larger machines, you can play music on your TRS-80 keyboard in real time. No programming is required.

The cassette is $14.95 from Micropute Software, Box 1943, Rock Mount, NC 27801. The program was written by James F. Williams, assistant professor of music at North Carolina Wesleyan College, who has been developing a "series of music-tutor programs for the TRS-80 which are now in use by the music-theory classes at N.C. Wesleyan."

The display shows a two-manual organ keyboard overlaid with the corresponding TRS-80 keyboard characters.



```
! ↑ ! Q ! W ! E ! R ! T ! Y ! U ! I ! O ! P ! @ ! ◆ ! ◆ !
ORGAN (C) 1979  BY  JAMES FULLER WILLIAMS   TREMOLO  TIMBRE
MICROPUTE  BOX 1943, ROCKY MOUNT, NC 27801   VALUE    VALUE
                                               3        5
                                             ENTER    CLEAR
                                            LOUDNESS  TIMBRE
! Z ! X ! C ! V ! B ! N ! M ! , ! . ! / !      ◆        ◆
```

When a key is pressed, an asterisk appears on the corresponding displayed organ key.

You can record your performance directly onto cassette tape, but to hear in real time what you're playing, you should connect the AUX plug to an audio amplifier, or to a cassette recorder that has a monitor.

The instructions say you can play the keyboard "as though it were a two-manual, three-octave electronic organ." Well, not quite, because no two (or more) notes can be sounded simultaneously.

If you press R and Y together, you get a warbling effect, as the C and E notes sound alternately. If you press R, Y and I together, you get the same warbling effect, but at a slower rate, and the sound is less musical than with two notes, especially in a lower octave.

The program provides two "stops" (loudness and timbre) and two controls (tremolo value and timbre value). Press ENTER, and the loudness changes from loud to soft, or vice versa. Press CLEAR, and the timbre changes from a nasal sound to a clear tone, or vice versa.

The tremolo and timbre values can be varied between 0 and 9. The higher the tremolo value, the slower the two notes alternate from one to the other. The higher the timbre value, the less nasal the sound.

This isn't really meant to be played as a two-manual organ, because if you press more than two notes, you may produce more notes than wanted, because of the ambiguities of the matrix keyboard arrangement. So perhaps it's better to consider this as a 3-1/3 octave single-keyboard organ, divided into two parts for display convenience.

Instructions show how to hook up and operate the organ, tell how the program works (using a flowchart), and end with this caveat:

"A typewriter keyboard does not lend itself to easily accomplished performances. Single-note tunes can easily be picked out and simple two-part arrangements work very well with a little practice. However, if you are interested in performing Bach's *Toccata and Fugue in D Minor,* even the most accomplished keyboardist would find severe limitations. More than a serious musical instrument, ORGAN is a demonstration of the flexibility of Z-80 software and the TRS-80 to perform unusual tasks with a little programming ingenuity. And it's a lot of fun for $14.95."

A very candid statement that just about says it all, for what may be the only real-time organ program for the TRS-80. However, I've suggested to one of the light-pen companies that a displayed organ keyboard could easily be played in real time with a light pen, so they may be working on it.

I/O & Auxiliary Control Center

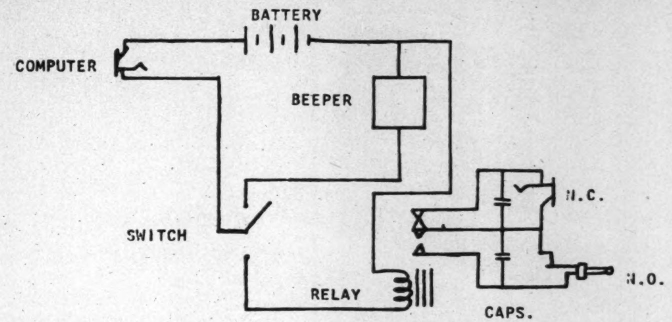
Dick Fuller has come up with another useful device for the TRS-80. His first was the RF-II, a dual-cassette switchbox (March 1979, p 128), which I keep plugged into my machine all the time.

The RF-III is an I/O auxiliary control center. For $39.95 (plus $2 for shipping, from Fuller Electronics, 7465 Hollister Ave., Suite 232, Goleta, CA 93017), you can control lights, video recorders and appliances, with on/off times ranging from fractions of a second to months (if you want to leave your TRS-80 on that long).

Basically, the RF-III is a TRS-80 controlled beeper and relay, with access provided to the relay's contact points. You simply plug the subminiature plug from the TRS-80 into the RF-III, and the plug on the RF-III cable into the REMOTE jack on the cassette recorder.

The RF-III is small, only 2 by 4 by 1½ inches in size. A two-position switch (BEEPER and RECORDER) permits the unit to be used either with programs that feature the beeper, or for "normal" operation.

The RF-III's beeper operates under software control, using either Basic or assembler. The beep can be used for sound effects in games, or to signal the end of a long sort, etc. The duration of the beep and the interval between beeps are program-controlled.



The RF-III comes with instructions that include directions and a parts list for constructing a 100-volt appliance controller for about $30.

Also, programs are provided in Basic for adding a beep to your programs, and for a telephone dialer, beep on program error, on/off (up to 20 times) for appliance control, random on/off for appliances (for lights when you're away, etc.), and a timer "for those without an interface or disk."

Once you've learned basic beeping, you can move into advanced areas such as using different numbers of beeps to signal what part of a program you're in.

The relay in the RF-III handles up to 1,000 mA, so you could control a reel-to-reel tape recorder, "or perhaps CSAVE on up to six cassette recorders," according to the instructions.

The RF-III's relay is battery-powered, and "protects the small relay within the computer itself. This means, when using the CTR-41 or CTR-80, instead of 160 mA going through the computer's relay, only about 16 mA actually does. Our computer has been to the repair center when the relay in the computer froze because the relay just couldn't handle the load of the cassette recorder."

If you own a solid-state relay for protecting the computer's relay, you can "remove it entirely from the system. The RF-III will do much more than the buffer."

The instructions also note that the RF-III "will only do one thing at a time... if it is controlling your coffee pot, you can't use it for other purposes."

LPRINT/LLIST Plug

Another of Dick Fuller's devices, his LPRINT/LLIST plug (June 1980, p 170), has brought comment from Eric Hazen of Ann Arbor, MI. He notes that the plug "prevents lockup when a printer command (LPRINT or LLIST) is issued with the line printer turned off or disconnected."

The problem arises when disk or expansion interface is connected.

Eric continues, "I would find this very useful as I make extensive use of a printer. After a few minutes of experimentation, I discovered that the same feat can be accomplished in software by typing the following commands from Level II Basic.

"To disable printing (printer may be left connected):

```
POKE 16421,0
```

to return to normal operation:

```
POKE 16421,6
```

"These commands simply enable and disable the printer device control block in reserved RAM. With all respects to Dick Fuller, a one-line command is certainly an easier way for TRS-80 users to disable the printer port than spending $11.95 for his plug."

Dick's comment on this letter is "most of the things you can do in hardware, you can also do in software. The thing about this plug is that it's handy." He also noted that LPRINT and LLIST can be changed to PRINT and LIST (and vice versa) with Scripsit, using a simple global change.

The "raw cost of the plug," which has gold-plated contacts, is the main part of the $11.95 price. The rest of the hardware is wiring.

Scripsit Index

Another Fuller Electronics product is an index to the Scripsit word processor (June 1980, p 166), which Radio Shack, as usual, didn't include in the manual.

This three-page computer-generated index, with two columns per page, contains over 200 items, and covers both the Scripsit manual and the reference card.

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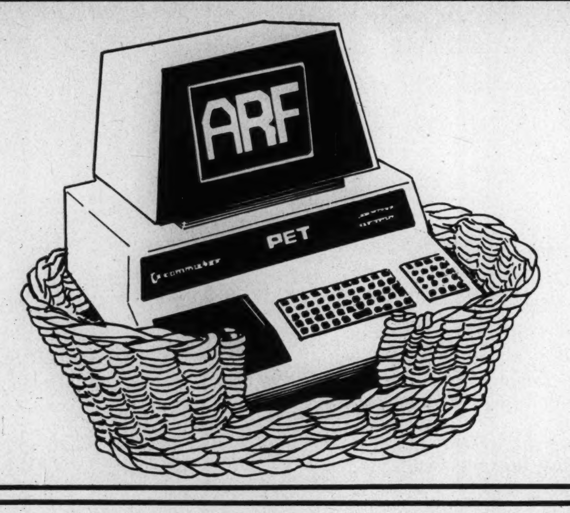
CIRCLE 201 ON READER SERVICE CARD

Personal Electronic Transactions

by Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.



Why I Have Been Away

If you are a reader of our competition (Kilobaud Microcomputing), perhaps you have noticed the full-page ad by Exatron, extolling the "Stringy Floppy." The Stringy Floppy is a miniature cassette tape drive which can load and save programs about 10 times faster than the PET's tape unit. Well, Exatron asked me if I could produce a version of the Stringy Floppy for the PET, and the last few months were fully occupied by this.

The Stringy Floppy

I will now describe to you the capabilities of the PET Stringy Floppy. (Exatron is located at: 181 Commercial Street, Sunnyvale, CA 94086 and the Stringy Floppy costs about $300.)

The Stringy Floppy comes in a case about 6″ x 4″ x 3″ with a ribbon cable leading to a small 2″ x 3″ card which plugs into the PET's User Port. The card has extension fingers to permit other User Port devices, including other Stringy Floppys up to a total of four tape drives. Jumpers inside the Tape Drive's case are used to set the drive number from 0 to 3. (0 is the default drive number.) A small transformer unit similar to those used for calculators leads to the 110v wall socket for power.

The tape cassettes are called "wafers" and are about the size of a business card and ⅛″ thick — this is a very compact size, and many users store their wafers in the plastic binder inserts used for business cards. Wafers come in different lengths, from 5 feet to 50 feet in length. An 8K program will fit on a 10 foot wafer. (This is a true 8K, not the 7167 bytes free). Physically, the tape runs at about 10ips, and an 8K program will be loaded in under 15 seconds.

Also provided with the unit is a 2K ROM which plugs into the $9000 slot in the PET's ROM. (Various other methods of attaching ROMs are available — if you can put a Programmer's Toolkit on the PET, you can mount the Stringy Floppy ROM.)

Once you are set up per the User's Manual, starting the Stringy is simple — a SYS 36864 does the trick. A sign-on message appears, and the Stringy is now "wedged" into the PET, that is, all Stringy Floppy commands can be executed directly or as part of a Basic program. Let's look at the commands:

@END — This is the "rewind" function for a wafer. Stringy wafers are endless tapes with an end marker. @END will run the tape at Fast Forward and leave the tape positioned just following the end marker. If you have more than one tape unit, @END 1, @END 2, and @END 3 will apply to these. (The same convention is true of all other commands.)

@NEW — This "formats" a wafer. Since most wafers come with a test pattern on them, @NEW isn't really needed — however, it is a good way to erase an old wafer.

@LIST — Since several programs may be stored on a wafer, this provides the "directory" function. The wafer is rewound and then scanned for file headers. The filename and filetype (Basic, 6502 or DATA) are shown, and the wafer stops just after the end marker. @LIST may be given two parameters, drive number, and any number (i.e., @LIST 0,1) to only show the files remaining on the tape.

@LOAD — To load a program, @LOAD will look for a fileheader and then load the program. Files may be named in *exactly* the same way as normal PET tapes and will be searched for in *exactly* the same way. For example, @LOAD "FOOTBALL,"2 will look for "FOOTBALL" on Drive #2.

@RUN — This performs the "load and go" function of loading and then executing the program. @RUN is permitted in Basic programs and will perform the "chaining" functions of the PET's LOAD. If the new program is larger than the current program, the message "OVERFLOW" will point this out. @RUN will also load and execute machine language programs.

@SAVE — In normal use, @Save willl save your Basic program in the usual manner. For machine language, you can specify the addresses in either decimal or hexadecimal, and if you want, the starting address as well. Some examples will clarify this:

@SAVE "MUGWUMP" — Saves MUGWUMP on Drive #0 as a Basic program.

@SAVE "MEM TEST",0,1024,2400 — Saves MEM TEST as a 6502 program from addresses 1024 to 2399 in decimal.

@SAVE "CRIT PATH",1,$2000,$2200,$2100 — Saves CRIT PATH from hex $2000 to hex $2200, with program start at $2100 (hex).

If no starting address is given, the first save address is used instead.

@THEN — In normal use, error messages like "FILE NOT FOUND" are printed on the screen and the program halts. @THEN provides four options for error messages:

0 — Show error & halt program.
1 — Don't show error & do halt program.
2 — Show error & continue running program.
3 — Don't show error, keep running.

@THEN will not stop normal Basic messages like SYNTAX ERROR and their effects — only Stringy errors are handled. To detect errors when you want to keep running, the Basic "status" variable is set by an error to a value from 1 to 8 to indicate which error is present.

@VERIFY is the last command and performs the normal VERIFY function for programs.

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PET, cont'd...

One important detail — all numbers and strings allow *any* Basic expression instead, for example,

```
@SAVE A$+".EXT",A+7,
    42*SIN(3.8),$55
```

is a legal command. One exception — hex quantities can't be expressions (which won't bother anybody I know . . .)

If you wish to abort an operation, pressing the RUN/STOP key will do the trick in all cases with a BREAK IN xxx message.

In about 6 months, a "Level II" version will arrive with these additional commands:

@DEF — Define data buffer storage areas.

@PRINT# — Print sequential data.

@INPUT# — Read data.

@GET# — Read one character.

@OPEN — Define a data file (one per drive unit).

@CLOSE — Undefine a file & write last buffer to tape.

The Stringy Floppy is pretty nifty — I hope you like it.

Product Reviews

During the time spent on the PET Stringy Floppy, about 10 products were sent to me for review in this column. There's no problem with the ones I don't like — I say so and move on. The ones I like take longer, for I like to do a few examples which don't come with the product to get the "feel" of it. Let's get on with it . . .

Microphys Programs

Our preconceptions often delay the development of good things when a new tool comes along, and this is especially true in the field of education. Back in the days of yore, a Dr. Skinner discovered how to train simple-minded creatures, like pigeons, to execute complex patterns of behavior by giving them small rewards and punishments at the right time. Thus began "Behavioral Psychology" which had a large influence on the concept of learning, especially the one seen by academia.

The essential idea was to break a task down into an almost innumerable quantity of smaller ones, and to teach each task, or "frame" individually and to then build up into larger blocks of behavior. The parallel between this and programming computers is obvious (Consider "Structured Programming" and "Top-Down Design" for example), and "Programmed Texts" with "frames" and branches to other frames, etc., soon appeared. This method is now applied to small computers and goes by the name CAI, for "Computer Assisted Instruction."

Building good CAI is rather a fine art, and when it is ineptly done, the skilled students are *bored stiff* and the not-so-skilled simply get frustrated.

(An Aside . . .)

I have noticed in the world of bleepo-computers (sorry about that, Ted . . .) the "dancing bear" phenomenon. It doesn't have to work very well, but if it even exists, that's a sufficient miracle. At this point, some really nice software, especially tools and simulations, are available, which leads to two kinds of personal software:

1. Truly personal — the stuff you do for fun, or to get some particular job done, and who cares if it is messy and has some bugs?

2. Software for sale, which in my book, must work, preferably perfectly, do something useful, fun or of interest, and not cost more than its media's weight in gold.

I have no compunction about raking Software #2 over the coals, for lousy software take time, money, and adrenalin.

Back to Microphys

Microphys (2048 Ford Street, Brooklyn, NY 11229) sent me a demonstration disk and a folder with Xerox copies of one and two sheet descriptions of the demo programs. Also enclosed was a catalog listing about 100 programs at the high school level in Physics, Chemistry, Math and Vocabulary.

The first program on the disk is a "disk utility" which handles such things as formatting, directory, disk history, etc. Then follows 12 demo programs, and I took a look at the first one. The program asked my name, displayed a definition from physics and then drew a graph. As I continued pressing "C" for Continue, the graph went away and a question appeared. (Now I had to go back to the graph to find the answer.) After going between the graph and the question several times, the graph *and* the question finally appeared on the screen at one time. We marched onwards through acceleration and a few other matters. About this time it becomes clear that the PET has been "STOP-proofed" and the only way to get my PET back is to plug on through the lesson.

The other lessons were very similar, falling into two classes, "lessons" and "reviews." In each case a fixed sequence with few branches was applied, and the explanations for incorrect answers were scanty and condescending in tone.

I do not recommend the Microphys programs from the examples I have, and though Microphys is the first (and possibly only) vendor for high school level CAI, I respectfully suggest that you make your own lessons instead.

So What Should Be Done?

A beautiful way to teach a subject is to incorporate the material in a simulation. The BAT program by Cursor is a very nice example of how the physical forces of acceleration, reflection, drag and energy combine in your efforts to keep the bat in the air and catching enough bugs to stay alive. Once the "feel" of a situation is present, then move on to the math. Starting with the bat in spot A with speed, energy, etc., and the bug at B, what is the best course of action? A modified version of BAT could permit a "freeze" followed by entry of your calculations and suggested moves. "Unfreeze" then shows what happens.

The better computer simulations always give you some situation and role, like keeping the bat alive and you are the batpilot. There's no reason to keep repeating the same dull inanimate ideas for computers in education.

Two Anti-Glare Screens for the PET

I am sure you have seen those dark plastic-covered screens for CRTs which improve their visibility, especially in a brightly lit room. These screens work by polarizing the light which passes through, resulting in a 40% transmission for the light coming from the screen to you, and only about 10% for the light coming from the outside and reflecting back to you.

The Plexi-Vue screen cover is made by Competitive Software, 21650 Maple Glen Drive, Edwardsburg, MI 49122. This cover is shaped in the trapezoidal form of the PET's bezel and comes with some adhesive foam strips. Installation is very easy, just remove the protective plastic films and the paper over the adhesive strips and press into place. One nice thing about this is you have the illusion of a larger display screen.

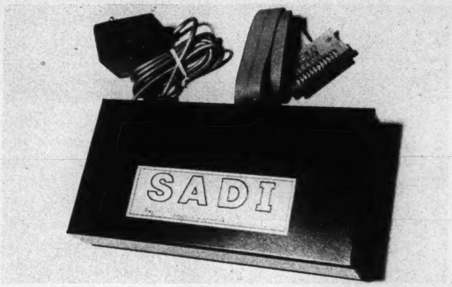
The instructions are clear and detailed, and mention a fix for those PETs which may have had their bezels waxed or made otherwise hard to stick to.

Two minor cautions: 1) If you use a lightpen, the Plexi-Vue will force the pen to be about ½" from the screen and to work with much less light. One solution is to make a hinge along the top of the PET with adhesive tape to permit flipping the screen upwards when lightpens are in use. 2) Be sure to completely clean your PET's screen before installing the Plexivue, as it is rather hard to remove cleanly.

The normal price of the Plexivue is $14.95, but if you mention this column within 30 days, the price is $11.95. (Note: and $1.00 for shipping.)

The other anti-glare screen is made by Pf Research, 866 Hummingbird Drive, San Jose, CA. The price is $11.49 postpaid, and a $1.00 discount per screen for 5 or more. The Pf screen is the same size as the PET's CRT and is pressed into the center of the PET's bezel. Two rubber inserts on each side of the screen keep it from falling out. The Pf screen looks a bit more "natural" and can be removed (with the help of a table knife) as needed. (Note: I also own the H-19 terminal, and Pf makes a screen for H-19s as well.)

PET TWO-WAY RS-232 and PARALLEL OUTPUT INTERFACE



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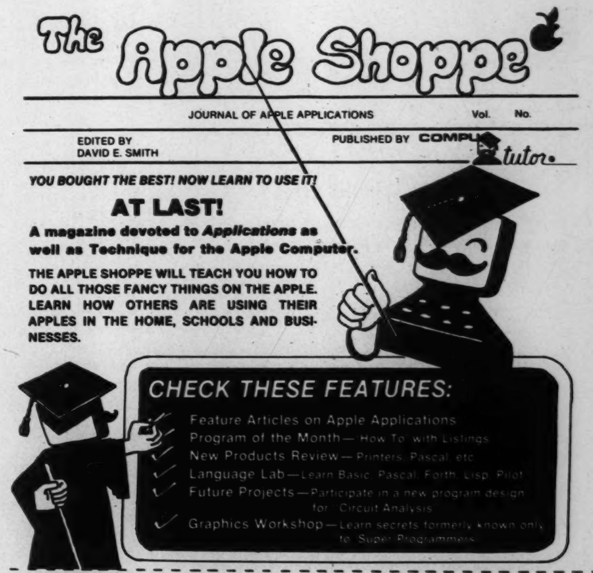

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CIRCLE 249 ON READER SERVICE CARD

Pet, cont'd...

I personally do not operate my PET in a well-lit area, so my need for anti-glare screens is not too great. If your PET lives on the kitchen table that's another story.

A 17-Program Grab Bag

Competitive Software also offers a disk of programs called SOFTPAC-1 for $29.95 (+$1 for shipping) provided you mention this column. The disks (2 of them, one as a backup!) arrive in a white plastic binder with notes for each program and listings for the "hello" and "serious" programs. Eight games and 9 utility programs are offered.

The games are a typical lot, i.e., CHASE, BREAKOUT, OTHELLO, TANK. These are done in a workmanlike manner — not very zippy, but most of them work reasonably well. Some programs, like TANK, wouldn't load from the "hello" program — I would get the "OUT OF MEMORY" error instead. The repartee in STRATEGY had a misspelling.

The utilities had one interesting program — a memory test which went at a moderate speed. The others, like HOME UTILITIES did the usual (yawn) loan, gas mileage and electric bill pseudo-useful programs. These did *not* check for bad entry data (I got a negative gas mileage) and I prefer to use my calculator for these things as it is handy and much more portable than my PET. All in all, a year's subscription to CURSOR is by *far* a better buy!

Please, all you software entrepreneurs out there, send me programs with some life to them, and with *original* ideas, and no bugs! Am I asking the impossible? Surely I almost fell asleep looking at these programs — do you want to have the same fate?

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CIRCLE 133 ON READER SERVICE CARD

A Phonetasy

If you look at a telephone dial, some of the numbers also have letters too. For example, 266-7883 can be dialed as COMPUTE. An interesting exercise is to find out which combinations of letters correspond to your phone number. Some numbers are easy to do — and others, like mine, are quite difficult. The program below provides an exhaustive list of the letter combinations for a 7 digit phone number. When I searched my list, my phone number became FANIZEY.

```
10 PRINT"clr PHONE NUMBER WORDS
20 PRINT"clr WILL PRINT A LIST OF THE
   POSSIBLE
30 PRINT"LETTER COMBINATIONS FOR YOUR
40 PRINT"TELEPHONE NUMBER.
50 OPEN 4,4
60 PRINT#4,CHR$(30)
70 PRINT#4,"PHONE WORDS FOR: sp";
80 DIM D$(9),D(9),P(7),W$(7)
90 FORJ=0TO 9: READ D$(J): D(J)=LEN
     (D$(J)):NEXT
100 DATA 0Z,1,ABC,DEF,GHI,JKL,MNO,
     PQRS,TUV,WXY
110 INPUT"dn dn YOUR PHONE NUMBER
     DDD-DDDD";P$
120 REM GEN A STRING
130 IF LEN(P$)<>8 THEN 110
140 IF MID$(P$,4,1)<>"-" THEN 110
150 PRINT#4,P$: PRINT#4
160 P$=LEFT$(P$,3)+RIGHT$(P$,4)
170 FOR J=1 TO 7
180 P$(J)=ASC(MID$(P$,J))-48
190 NEXT J
200 PRINT P$
210 REM MAKE A WORD
220 FOR A = 1 TO D(P(1))
230 W$(1)=MID$(D$(P(1)),A,1)
240 FOR B = 1 TO D(P(2))
250 W$(2)=MID$(D$(P(2)),B,1)
260 FOR C = 1 TO D(P(3))
270 W$(3)=MID$(D$(P(3)),C,1)
280 FOR D = 1 TO D(P(4))
290 W$(4)=MID$(D$(P(4)),D,1)
300 FOR E = 1 TO D(P(5))
310 W$(5)=MID$(D$(P(5)),E,1)
320 FOR F = 1 TO D(P(6))
330 W$(6)=MID$(D$(P(6)),F,1)
340 FOR G 1 TO D(P(7))
350 W$(7)=MID$(D$(P(7)),G,1)
360 W$="":FORJ = 1 TO 7: W$=W$+W$(J):
      NEXT
370 PRINT W$
380 PRINT#4,W$" sp ";
390 NEXT G,F,E,D,C,B,A
400 PRINT#4
```

The program asks for your number in the form DDD-DDDD, turns on the printer, and then fills about six pages with possible combinations of letters for your number. If you don't have a printer, make these changes:

Lines 50,60 — delete.
Line 70 — change the PRINT#4, to a PRINT.
Line 110 — change to line 50, delete the old line 110.
Line 150 — change PRINT#4, to PRINT (two of them).
Lines 130,140 — change THEN 110 to THEN RUN.

Then enter these lines:

```
370 PRINT W$"sp";
380 T=T+1:IF T>89 THEN 400
395 END
400 PRINT:PRINT"PRESS KEY TO CONTINUE"
410 GETA$:IFA$=""THEN 410
420 T=0:GOTO 390
```

In Line 80, array D$ holds the letters for each digit 0-9. The array D holds the number of letters in each case — some values, like 1, only hold one letter (I use "1" since there aren't any letters on the phone dial for "1") and most hold three letters. The array P holds the individual digits of the phone number, which are computed in Line 180. The preceding lines check the phone number string P$ for gross errors and remove the "-" character.

Lines 220 through 350 comprise a gigantically nested FOR-NEXT loop which goes through each possible letter combination. The rightmost digit is the innermost loop, so the letter combinations end up printed in alphabetical order. The letters are accumulated in the array W$ and combined into the string W$ in Line 360, and printed in Line 380.

The changes for non-printer owners remove the PRINT#4 lines and pauses the display every 90 combinations to permit your inspection of them. Note that Line 390 terminates all of the loops in one NEXT statement.

Below is a short sample of my printer's output for this program to give you an idea of what to expect. (If some of you like to try numbers such as Commodore or *Creative Computing*, let me know and I will mention the interesting ones.) ☐

```
PHONE WORDS FOR: 326-4039
DAMG0DW DAMG0DX DAMG0DY DAMG0EW DAMG0EX DAMG0EY DAMG0FW DAMG0FX DAMG0FY DAMGZDW
DAMGZDX DAMGZDY DAMGZEW DAMGZEX DAMGZEY DAMGZFW DAMGZFX DAMGZFY DAMH0DW DAMH0DX
DAMH0DY DAMH0EW DAMH0EX DAMH0EY DAMH0FW DAMH0FX DAMH0FY DAMHZDW DAMHZDX DAMHZDY
DAMHZEW DAMHZEX DAMHZEY DAMHZFW DAMHZFX DAMHZFY DAMI0DW DAMI0DX DAMI0DY DAMI0EW
DAMI0EX DAMI0EY DAMI0FW DAMI0FX DAMI0FY DAMIZDW DAMIZDX DAMIZDY DAMIZEW DAMIZEX
DAMIZEY DAMIZFW DAMIZFX DAMIZFY DANG0DW DANG0DX DANG0DY DANG0EW DANG0EX DANG0EY
DANG0FW DANG0FX DANG0FY DANGZDW DANGZDX DANGZDY DANGZEW DANGZEX DANGZEY DANGZFW
DANGZFX DANGZFY DANH0DW DANH0DX DANH0DY DANH0EW DANH0EX DANH0EY DANH0FW DANH0FX
DANH0FY DANHZDW DANHZDX DANHZDY DANHZEW DANHZEX DANHZEY DANHZFW DANHZFX DANHZFY
DANI0DW DANI0DX DANI0DY DANI0EW DANI0EX DANI0EY DANI0FW DANI0FX DANI0FY DANIZDW
DANIZDX DANIZDY DANIZEW DANIZEX DANIZEY DANIZFW DANIZFX DANIZFY DAOG0DW DAOG0DX
```

A New Type of Game

Welcome to an astonishing new experience! **ADVENTURE** is one of the most challenging and innovative games available for your personal computer. This is not the average computer game in which you shoot at, chase, or get chased by something, master the game within an hour, and then lose interest. In fact, it may take you more than an hour to score at all, and will probably take days or weeks of playing to get a good score. (There is a provision for saving a game in progress).

The original computer version of Adventure was written by Willie Crowther and Don Woods in Fortran on a PDP-10 at MIT. In this version the player starts near a small wellhouse. Upon entering the house, he finds food, water, a set of keys and a lamp. Armed with only these items, he must set out to explore the countryside in search of treasure and other objects of play. He must also confront dwarfs, snakes, trolls, bears, dragons, birds, and other creatures during his quest. The game accepts one-or two-word commands such as GET LAMP* SOUTH* or KILL DWARF. Of course, if you don't have the proper tool to carry out an action, or if you do something foolish, you may find yourself in big trouble.

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.

Adventure

For Apple, TRS-80, Sorcerer, PET, CP/M

MISSION IMPOSSIBLE ADVENTURE (by Scott Adams) - Good Morning, Your mission is to... and so it starts. Will you be able to complete your mission in time? Or is the world's first automated nuclear reactor doomed? This one's well named, its hard, there is no magic but plenty of **suspense**. Good luck.....

THE COUNT (by Scott Adams) - You wake up in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's LOVE AT FIRST BITE.....

ADVENTURELAND (by Scott Adams) - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter WILD ANIMALS, MAGICAL BEINGS, and many other perils and puzzles. Can you rescue the BLUE OX from the quicksand? Or find your way out of the maze of pits? Happy Adventuring.....

VOODOO CASTLE (by Scott Adams) - Count Cristo has had a fiendish curse put on him by his enemies. There he lies, with you his only hope. Will you be able to rescue him or is he forever doomed? Beware the Voodoo Man.....

ORIGINAL ADVENTURE (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a collosal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual** —you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

PIRATE ADVENTURE (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey.....

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TRS-80 Level II (16K) Machine language cassettes for only $14.95
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CS-3008 Pirate Adventure
CS-3009 Mission Impossible Adventure
CS-3010 Voodoo Castle
CS-3011 The Count

TRS-80 Disk (32K) Menu driven machine language routines for only $24.95
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Sorcerer (16K) Machine language cassettes for only $14.95
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CS-5005 Mission Impossible Adventure
CS-5006 Voodoo Castle
CS-5007 The Count

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CS-4005 Haunted House

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Adventures for your 32K Apple on cassette, $14.95
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CS-4012 Pirate Adventure
CS-4013 Mission Impossible Adventure
CS-4014 Voodoo Castle

(48K) Adventures for your 48K Apple on disk, $24.95
CS-4509 Adventureland and Pirate Adventure
CS-4510 Mission Impossible Adventure and Voodoo Castle

Pet (24K), $14.95 turns your Pet into a land of enchantment.
CS-1009 Pirate Adventure and Adventureland

Sensational Savings! Take advantage of the one dollar discount certificate on page 135 redeamable at your local computer store. Or you can order directly from **Creative Computing Software** Dept. AFGG, P.O. Box 789-M, Morristown, NJ 07960. Send payment plus $1 shipping and handling. For faster service call in your bank card order to (800) 631-8112. In NJ call (201) 540-0445.

For a FREE Sensational Software Catalog of over 400 programs for eight popular systems circle reader service #300.

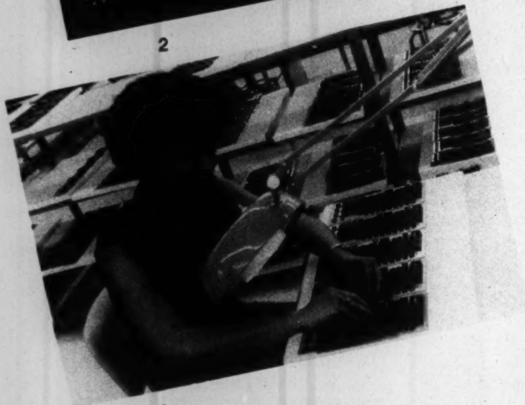
A Visit to California Computer Systems

California Computer Systems of Sunnyvale, CA manufactures a complete line of S-100 and Apple computer boards. In addition, part of their modern manufacturing facilities are used to make boards and subassemblies for other companies such as Microsoft and Prolog under contract.

On their own products, their strategy is to first survey the existing products on the market and then design one that has as many features as possible of all the competitors and sell it at an economical price. Examples of this design strategy include their line of S-100 boards: a Z-80 CPU for $300, a disk controller with CP/M 2.2 on the board for $400 and a 64K dynamic RAM for $700.

1

2



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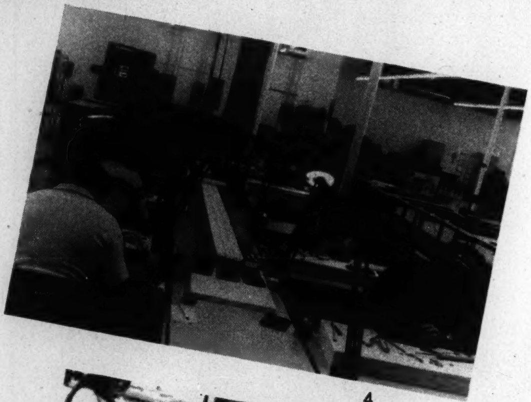

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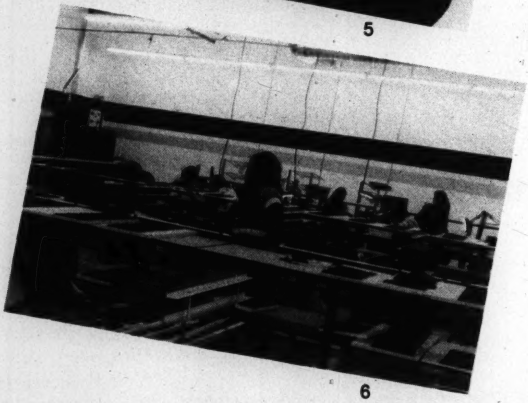
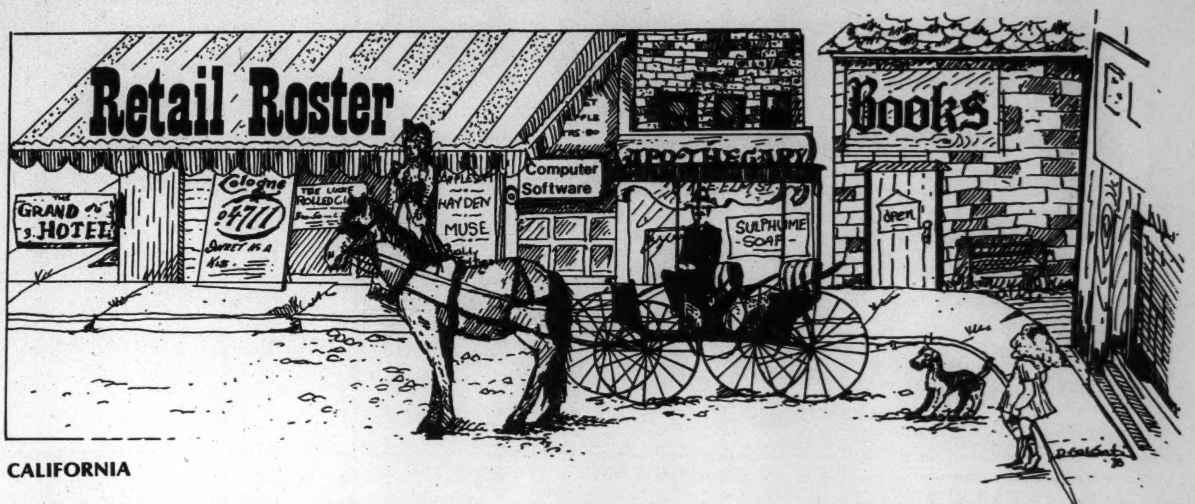


6

1. Designing the mask.
2. The engineering area has posh wood work tables and carpeting.
3. Component insertion.
4. Touch-up line after wave soldering.
5. Trace analyzer in operation.
6. Manufacturing flow is monitored by an advanced Xerox timesharing MRP system.

Photos by David Ahl.



CALIFORNIA

The Computer Store—820 Broadway, Santa Monica 90401; (213) 451-0713. 10 am-8 pm Tue-Fri, 10-6 Sat. The Original One! Apple/Vector Graphic.

D.E.S. Data Equipment Supply—8315 Firestone, Downey 90241. (213) 923-9361. 7 days. Commodore PET specialists. Hardware Software, Books, Mags, Supplies, In House Maintenance.

PC Computers—10166 San Pablo Ave, El Cerrito 94530; (415) 527-6657. 9-5:30 Mon-Sat. Commodore Pet, Compucolor and Atari.

Omni Unlimited—105 So. Los Robles (across from Hilton), Pasadena 91101. (213) 795-6664 or 629-1277 (LA). M-F: 9-5, Sat. 10-4. Billings and Commodore computers and supplies and forms plus peripherals.

CONNECTICUT

The Computer Store—63 S. Main St, Windsor Locks 06096; (203) 627-0188. 10-6 MTWF, 10-8 Thu, 10-4 Sat.

Computerworks—1439 Post Rd. East, Westport 06880; (203) 255-9096. 12-6 Mon-Sat., 12-9 Thurs.

FLORIDA

AMF Electronics—11158 N. 30th St, Tampa 33612; (813) 971-4072. 10-6 Mon-Sat. Apple Computer Sales & Service; TRS-80, Apple Software & Peripherals; S-100 boards, computer parts & books.

GEORGIA

Atlanta Computer Mart—5091 Buford Hwy, Atlanta 30340; (404) 455-0647. 10-6 Mon-Sat.

ILLINOIS

ComputerLand/Downers Grove—136 Ogden Ave, Downers Plaza 60515; (312) 964-7762. 10-6 Mon-Sat, 10-8 Tue, Thu.

The Computer Room—106 E. Oak St, Chicago 60611; (312) 337-6744. 11-7 Mon-Fri, 11-6 Sat.

Data Domain of Schaumburg—1612 E. Algonquin Rd, Schaumburg 60195; (312) 397-8700. 12-9 Tue-Fri, 11-5 Sat. Largest book & magazine selection.

Farnsworth Computer Center—1891 N. Farnsworth Ave, Aurora 60505; (312) 851-3888. M-F 10-8, Sat. 10-5 Apple, Hewlett-Packard, Corvus, HP Calculators, IDS-44OG printers.

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ComputerLand of Louisville—10414 Shelbyville Rd, Louisville 40223; (502) 245-8288. 10-5:30.

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Computer Mart, Inc.—1395 Main St, Waltham 02154; (617) 899-4540. 11-6 Tue-Sat. Atari, Heath, NEC, SWTP & S-100 bus systems; Word Processing Specialists.

Neeco—679 Highland Ave, Needham 02194; (617) 449-1760. 9-5:30 Mon-Fri. Commodore, Apple, Superbrain, TI 99/4.

NEW JERSEY

Computernook—Rt. 46, Pine Brook Plaza, Pine Brook 07058; (201) 575-9468. 10-6:30 MTWS, 10-8 Thurs., Fri. Apple/Commodore Authorized dealer.

Stonehenge Computer Shop—89 Summit Avenue, Summit 07901; (201) 277-1020. 10 am - 6:30 pm Mon-Sat. Apple/Bell & Howell/Commodore Authorized Dealer, Sales and Service.

NEW YORK

The Computer Corner Inc—200 Hamilton Ave, White Plains 10601; (914)-WHY DATA. 10-6 Mon-Sat, 10-9 Thu.

OHIO

The Basic Computer Shop—2671 W. Market St, Akron 44313; (216) 867-0808. 10-6 Mon-Sat.

Micro Mini Computer World, Inc.— 74 Robinwood Ave., Columbus 43213; (614) 235-6058, 5813. 11-7 Tue-Sat. Authorized Commodore dealer-Sales/Software/Service/Support.

PENNSYLVANIA

Artco Electronics—302 Wyoming Ave, Kingston 60145. (717) 287-1014. 10-7 (except Wed, Sun). TRS-80 Specialist.

VIRGINIA

ComputerLand/Tysons Corner — 8411 Old Corthouse Rd, Vienna 22180; (703) 893-0424. 10-6 MTWF, 10-9 Thu, 10-5 Sat.

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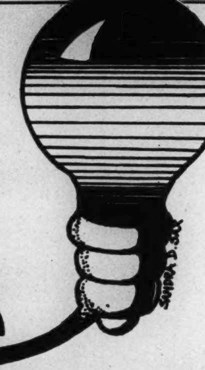
Compleat Computer Catalogue



APPLICATIONS SOFTWARE

RECREATIONAL, GAMES

Tuesday Night Football for the Apple II simulates NFL action between the player's Houston Oilers and the computer controlled Pittsburgh Steelers. The game includes 17 plays from offense and 6 defenses. Cassette, $13.95; disk, $17.95. Shoestring Software, 1235 Candlelight, Houston TX 77018. (713) 688-2105.

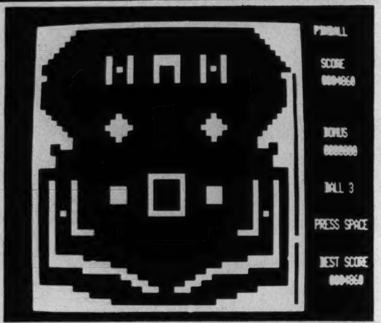
CIRCLE 301 ON READER SERVICE CARD

California Software has released a four-voice **Software Music Synthesis System** that uses a parallel port of the computer to output waveforms. Music written for the original Music System from Software Technology is compatible with the system. Available for most CP/M systems, Northstar DOS and Cuter cassettes, the system features a line editor, ML/1 music language compiler and programmable synthesizer. $79.95. California Software, Box 275, El Cerrito, CA 94530. (415) 527-7730.

CIRCLE 302 ON READER SERVICE CARD

Three programs for the PET using an Atari joystick have been announced by Programmatics Software. **Galacti-Target** is a real-time hand-eye coordination game in which the player pilots a ship around the galaxy. **Space Race** is a starship race in which the object is to gain speed and make better time. **Streets and Alleys** is a game of tag in a maze played against the computer. $4.95. Programmatics Software, 71 Sargent Ave., Providence, RI 02906.

CIRCLE 303 ON READER SERVICE CARD



Acorn Software Products announces **Pinball**, a real-time, arcade game for the TRS-80 Level II written in machine language. It includes flippers, bumpers, rollovers, runs, and bonus points. $14.95. Acorn Software Products, Inc., 634 North Carolina Ave., SE, Washington, DC 20003. (203) 544-4259.

CIRCLE 304 ON READER SERVICE CARD

In **Labyrinth Run** for the TRS-80 from Manhattan Software the player runs through a labyrinth with sharp turns, reverses and slaloms, racing for a record time. It features high-speed graphics and three skill levels. $9.95. Manhattan Software, Inc., P.O. Box 5200, Grand Central Station, New York, NY 10017.

CIRCLE 305 ON READER SERVICE CARD

Comco announces six games on cassette for the Ohio Scientific C1P, C2-4P and C8P computers. **Lunar Lander** is an 8K color program in which the pilot directs a spacecraft to a landing on the moon. The **Game of Life** is a 4K simulation of an ecology. In **Auto-tank** (8K) the player controls one tank and the computer controls the other. **Space Rebel** allows players to control the imperial klingon cruiser as it tries to destroy the federation starships. **Space Shuttle Simulator** (8K) is a self-prompting program which allows the user to generate CAI programs on cassette. Comco, 2214 Phelps Rd., Suite 208, Adelphi, MD 20783.

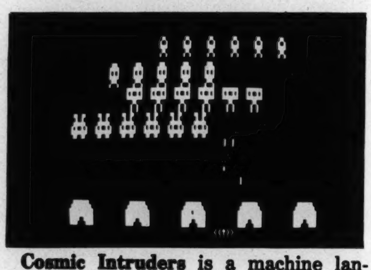
CIRCLE 306 ON READER SERVICE CARD

AppleRoots is a genealogy software package that can be used for conventional genealogy as well as animal breeding. It has 17 user-definable fields. Written in Applesoft, the program requires a single disk drive with 24K RAM. $39.95. CDS Corp., 695 East 10th North, Logan, UT 84321. (801) 753-6990.

CIRCLE 307 ON READER SERVICE CARD

Dungeon Explorer 2.0 is a single player game of combat and adventure in which the player tries to become a superhero by battling the monsters in the Dungeon of Xanadu. **Cosmic Trader** is a game of interstellar trade in which up to four players try to amass a fortune by commanding star freighters in quadrants consisting of nine star systems with nine categoris of trade goods. Both games are for the TRS-80 Level II with 16K RAM. $12.95. Simulation Software, P.O. Box 1368, Warren, MI 48090. (313) 758-0798.

CIRCLE 308 ON READER SERVICE CARD



Cosmic Intruders is a machine language space game with sound effects for the TRS-80 Level II, 16K. In this real-time game, the player must destroy the alien space creatures which appear in his gun sight. **Alien Invasion** is a TRS-80 version of Space Invaders. $9.95. Software Innovations, 320 Melbourne Rd., Great Neck, NY 11021.

CIRCLE 309 ON READER SERVICE CARD

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The COMPUMAX business applications programs are written with the novice computer user in mind. They are easy to use, yet powerful in their capabilities. Further, COMPUMAX supplies the BASIC source code. Thus the programs are easy to modify.

MICROLEDGER

This General Ledger system performs the essential functions of dual entry bookkeeping and matches revenues and expenses:
MICROLEDGER includes the following programs.:

LEDGER 1 - builds and maintains the CHART OF ACCOUNTS file. This file contains both current and accumulated totals for each account.
LEDGER 2 - builds and updates the JOURNAL TRANSACTION file.
LEDGER 3 - lists both the the JOURNAL file and the CHART OF ACCOUNTS.
LEDGER 4 - computes the TRIAL BALANCE and executes POSTING of journal transactions into the CHART OF ACCOUNTS. An AUDIT TRIAL of all transaction is output.
LEDGER 5 - produces the PROFIT AND LOSS STATEMENT.
LEDGER 6 - produces the BALANCE SHEET. Assets, liabilities and owners' equities are shown by account and by totals. **$140.00**

MICROPAY

An Accounts Payable system, MICROPAY includes the following program & functions:

PAY 1 - initializes both Transaction and Master files, then begins the Accounts Payable process by inputting and adding records in the Transaction file.
PAY 2 - allows for changes and deletions of Transaction and Master records.
PAY 3 - reports outstanding Accounts Payables in four categories; under 30 days, 31-60 days, 61-90 days, and over 90 days.
PAY 4 - reports all outstanding Accounts Payables for a single customer or for all customers, and computes Cash Requirements.
PAY 5 - reports all outstanding Accounts Payables for a single date or for a range of dates and computes the Cash Requirements.
PAY 6 - lists both the Transactions and Master files.
PAY 7 - prints checks and accumulates and journalizes Accounts Payables. This program simultaneously creates entries for the MICROLEDGER file. **$140.00**

MICROREC

An Accounts Receivable system, MICROREC includes the following programs and functions:

REC 1 - initializes Accounts Receivable files, adds A/R record and prints invoices.
REC 2 - accepts receipt of customer payments and changes or deletions of A/R Transaction or Master file records.
REC 3 - reports outstanding Accounts Receivables in four categories; under 30 days, 31-60 days, 61-90days, and over 90 days.
REC 4 - reports all outstanding Accounts Receivables for a single customer, or for all customers and computes Cash Projections.
REC 5 - produces reports for all outstanding Accounts Receivables for a single date or for a range of dates and computes Cash projections.
REC 6 - lists Transaction and Master files and accumulates and journalizes Accounts Receivables, creating JOURNAL entries which communicate with the MICROLEDGER JOURNAL file. **$140.00**

MICROINV

This Inventory Control system presents a general method of Inventory Control and produces several important reports. Its program includes:

INV 1 - initializes Transaction and Master files and adds and updates Transaction and Master records.
INV 2 - handles inventory issued or received, creating inventory records. This program also accumulates and journalizes transactions, producing JOURNAL entries which communicate with the MICROLEDGER file.
INV 3 - lists both Transaction and Master files.
INV 4 - produces the STOCK STATUS REPORT, showing the standard inventory stock data and stock valuation, and the ABC ANALYSIS breaking down the inventory into groups by frequency of usage.
INV 5 - gives a JOB COST REPORT/MATERIALS, showing allocation of materials used year-to-date by each job or work code. (This is complemented by the Job Cost Report/Personnel in the MICROPERS program.)
INV 6 - computes and provides the E.O.Q. (Economic Order Quantities) **$140.00**

MICROPERS

This is a Payroll/Personnel program whose functions include:

PERS 1 - initializes the Master file and allows for entry and updates of Master records.
PERS 2 - initializes the Payroll file and allows for entry and updates of payroll records.
PERS 3 - lists an Employee Master Record or the entire Employee Master file; lists a single Payroll Record or the entire Payroll file.
PERS 4 - computes Payroll and prints the PAYROLL REGISTER. Prints PAYCHECKS and creates JOURNAL entries to be fed into the MICROLEDGER JOURNAL file.
PERS 5 - produces the JOB COST REPORT/PERSONNEL, computes the quarterly 941 bank deposit, and the Annual W-2 run. **$140.00**

All COMPUMAX programs available in machine readable format (diskette form) for the following machines:

TRS-80™ Model I
APPLE II
PET
Micropolis 1053/11
Microsoft under CP/M
CBASIC under CP/M
Cromemco

FROM ADVENTURE INTERNATIONAL (By Scott Adams)

† 1. **ADVENTURELAND** - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter wild animals, magical beings, and many other perils and puzzles. Can you rescue the Blue Ox from the quicksand? Or find your way out of the maze of pits? Happy Adventuring .....

† 2. **PIRATE'S ADVENTURE** - "Yo ho ho and a bottle of rum" You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover Long John Silver's lost treasures? Happy Sailing, matey .....

3. **MISSION IMPOSSIBLE ADVENTURE** - Good morning, your mission is to...and so it starts. Will you be able to complete your mission in time? Or is the world's first automated nuclear reactor doomed? This one's well named. It's hard, there is no magic, but plenty of suspense. Good luck .....

4. **VOODOO CASTLE** - Count Cristo has had a fiendish curse put on him by his enemies. There he lies, with you his only hope. Will you be able to rescue him or is he forever doomed? Beware the Voodoo Man .....

★ *All orders processed within 24-Hours*

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5. **THE COUNT** - You wake up in a large brass bed in a castle somewhere in Transylvani. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's Love at First Byte .....

6. **STRANGE ODYSSEY** - Marooned at the edge of the galaxy, you've stumbled on the ruins of an ancient alien civilization complete with fabulous treasures and unearthly technologies. Can you collect the treasures and return or will you end up marooned forever? .....

7. **MYSTERY FUN HOUSE** - Can you find your way completely through the strangest Fun House in existence, or will you always be kicked out when the park closes? ...

8. **PYRAMID OF DOOM** - An Egyptian Treasure Hunt leads you into the dark recesses of a recently uncovered Pyramid. Will you recover all the treasures or more likely will you join its denizens for that long eternal sleep? .....

9. **GHOST TOWN** - Explore a deserted western mining town in search of 13 treasures From rattlesnakes to runaway horses, this Adventure's got them all! Just remember, Pardner, they don't call them Ghost Towns for nothin'. (Also includes new bonus scoring system!) .... **$14.95 Per Adventure**

* **Note:** Apple requires 24K and has no lower case.
† Recommended for the novice adventurer, with many built-in HELPS!

FROM PERSONAL SOFTWARE INC.

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GAMES, RECREATIONAL

Stratagems Company announces **Starcruiser,** a two-player game of interstellar exploration and conquest in which the players maneuver spacecraft through a cluster of 42 solar systems in search of planets with which to form alliances. The game is played with TRS-80 and two paper playing surfaces called star maps. $10. Stratagems Company, Box 786, Taylor, MI 48180.

CIRCLE 310 ON READER SERVICE CARD

Softpoint has introduced the following software for the Apple II and Apple II Plus: **Function Plot, Blockade, Speed Reading, Hangman, Blackjack** and **Road Race.** Prices range from $5.95 to $9.95. Softpoint, Dept. D., 103 Clinton Ave., Terryville, NY 11776.

CIRCLE 311 ON READER SERVICE CARD

Midway Campaign gives the player charge of the entire U.S. Naval Force in the Pacific during World War II. In **North Atlantic Convoy Raider,** the computer controls the British fleet and the player is the captain of the Bismarck. In **Nukewar** the computer controls a major power whose sole objective is to annihilate the good guys. **Planet Miner** offers one to four players a chance to compete with each other and with the computer to stake valuable mining claims throughout the solar system in the year 2050. **B-1 Nuclear Bomber** places the player in the cockpit of a supersonic bomber on a mission to bomb a Soviet city. All games are for Apple, TRS-80 and PET. $15. Avalon Hill Game Company, 4517 Harford Rd., Baltimore, MD 21214.

CIRCLE 312 ON READER SERVICE CARD

Strategic Simulations announces **Computer Ambush** for Apple II or Apple II Plus. The game features everything needed to simulate World War II squad combat, including a hi-res display of a French village. $59.95 on disk. Strategic Simulations, 450 San Antonio Rd., Suite 62, Palo Alto, CA 94306.

CIRCLE 313 ON READER SERVICE CARD

Musicraft is a CP/M-compatible screen editing music interpreter which produces up to four voices, each with a seven octave range and a different musical sound. It supports measures, musical line numbers, repeats, refrains, key signatures, accidentals and microtones. It requires an S-100 bus computer with addressable cursor and the Newtech Model 6 Music Board. $79.95. Newtech Computer Systems, Inc., 230 Clinton St., Brooklyn, NY 11201. (212) 625-6220.

CIRCLE 314 ON READER SERVICE CARD

EDUCATIONAL

Computer Systems Design Group announces **Grow,** an extensible system for authoring creative CAI programs, adventure games and dynamic knowledge networks. The manufacturer claims that the system can be used by people with little or no programming experience. Available on disk for Apple II and Northstar, $35. Computer Systems Design Group, 3632 Governor Dr., San Diego, CA 92122.

CIRCLE 315 ON READER SERVICE CARD

Program Design announces four titles to help students with vocabulary and reading skills. **Word Skills 2** and **Word Skills 3** cover common prefixes and suffixes. **Word Meanings** teaches synonyms, homonyms, antonyms and troublesome words. **Nouns** covers common and proper nouns on a high school level. The programs are available on cassette for Apple and PET, $14.95, and on Apple disk for $19.95. Program Design, 11 Idar Ct., Greenwich, CT 06830. (203) 661-8799.

CIRCLE 316 ON READER SERVICE CARD

MuMath for the TRS-80 with single disk drive is a symbolic math package designed for educational, scientific and engineering applications. It provides the facilities to do algebra, trigonometry, calculus, integration, differentiation and other symbolic math operations accurately and efficiently, MuSimp, the language in which the program is written, is included. $74.95. Microsoft Consumer Products, 10800 Northeast Eighth, Suite 507, Bellevue, WA 98004. (206) 454-1315.

CIRCLE 317 ON READER SERVICE CARD

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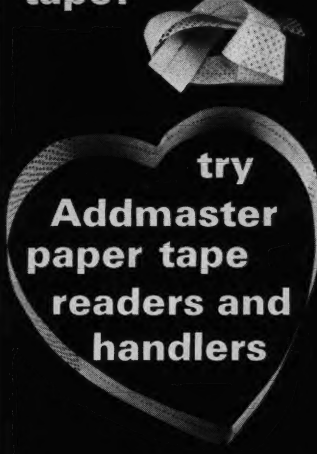

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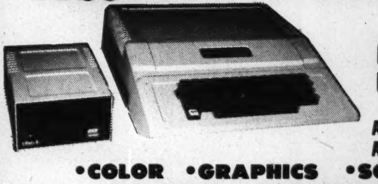

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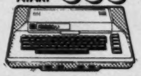

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EDUCATIONAL

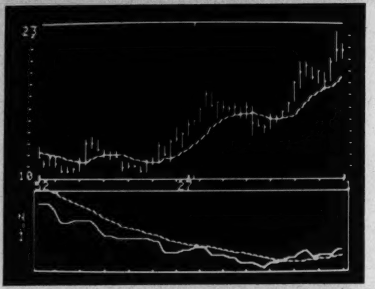
New from **Math Software** is a series of programs for the Apple designed to aid in the teaching of mathematics. Titles include: Taylor Series, Function Grapher 48K, Arithmetic of Functions, Binomial Multiplication, Rational Function Grapher, Solids Revolution, and Polar Graphing. Prices for disks are $15 for 32K programs and $25 for 48K programs. Math Software, 1223 Blackthorn Pl., Deerfield, IL 60015.

CIRCLE 318 ON READER SERVICE CARD

PERSONAL

APF Electronics announces the **Personal Business Machine** program for its Imagination Machine. The program allows the user to calculate financial status and compute loan amortization, interest and principal payments interest rates, etc. Prices range from $19.95 to $29.95. APF Electronics, Inc., 444 Madison Ave., New York, NY 10022. (212) 758-7550.

CIRCLE 319 ON READER SERVICE CARD



Market Charter is a technical analysis package for following stocks and commodities which features hi-lo-close charts, negative and positive volume indicator charts, volume charts and comparison charts. Written for the Apple II, it includes a file maintenance program which allows for the creation and updating of the data base and adjusts for stock splits. $99.95. RTR Software, P.O. Box 12351, El Paso, TX 79912. (915) 544-4397.

CIRCLE 320 ON READER SERVICE CARD

Money Manager is a 48K disk program for the Apple II which handles all of the user's financial affairs and creates a permanent data base for planning, evaluating and verifying all expenditures. **Time Manager** is a 32K personal data system that acts as an automatic reminder, electronic notebook and personal history file. Image Computer Products Inc., 615 Academy Dr., Northbrook, IL 60062.

CIRCLE 321 ON READER SERVICE CARD

E.S.P. Lab for the TRS-80 Level II 16K has been designed by Manhattan Software as a program for serious research into possible extrasensory phenomena, as well as for casual testing of the possibility of telepathy, clairvoyance, precognition and telekinesis. $9.95. Manhattan Software, Inc., P.O. Box 5200 Grand Central Station, New York, NY 10017.

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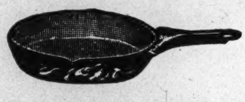

Nutri-Pack for the Apple II is a series of programs and a data base designed to evaluate the nutritional quality of a daily diet. It contains information on the caloric, fat and protein content and the levels of eight vitamins and minerals in the 600 listed foods. $39.95. Micro-Comp Incorporated, 2015 NW Circle Blvd., Corvallis, OR 97330.

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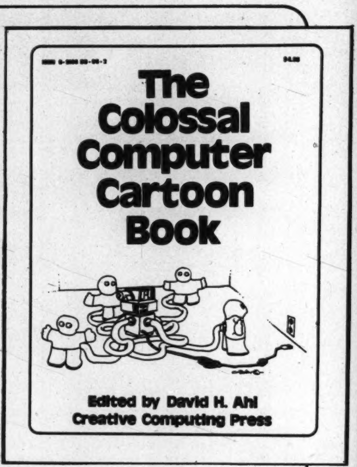
Edited by David Ahl, mastermind behind the April Fool's issue of Dr. Kilobyte's Creative Popular Personal Recreational Micro Computer Data Interface World Journal, this cartoon book contains much of that same incurable zaniness. [Want this issue? It's April 1980 and only $2.50 postpaid].



The Colossal Computer Cartoon Book

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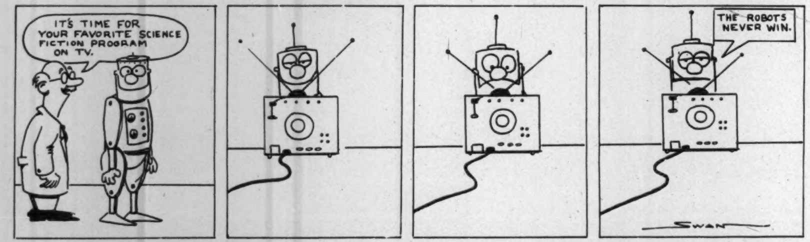
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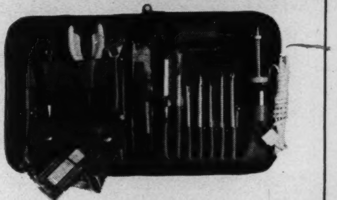

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CIRCLE 109 ON READER SERVICE CARD

WORD PROCESSING

A new version of the **WpDaisy** word processor software package has been designed for use with the TRS-80 Model II. The package includes Infosoft Systems' I/OS Disk Operating System, a basic operating system for 8080, 8085 and Z-80 CPUs. Infosoft Systems, 25 Sylvan Rd. South, Westport, CT 06880.

CIRCLE 324 ON READER SERVICE CARD

ESTERBROOK & CO

Micro Architect announces **Word-M2,** a word processing program for the TRS-80 Model II which allows the user to set page length, line width, skip pages and text, indent, center text, etc. $49. Micro Architect, Inc., 96 Dothan St., Arlington, MA 02174.

CIRCLE 325 ON READER SERVICE CARD

Services Unique introduces Disk **Apple II Report Textwrite** software designed to allow free form file input without regard to either line or page length. It assembles text into physical lines and pages using predefined operator or file parameters. $19.95. Services Unique, Inc., 2441 Rolling View Dr., Dayton, OH 45431.

CIRCLE 326 ON READER SERVICE CARD

Spellbinder

The **Spellbinder** word processing system is said to include all the features found on competitive software plus full mailing list/mailing label, sort/merge and text/merge capacity, and legal numbering. Written in 8080 assembly language and designed to run under CP/M, it is available in the following formats: IBM 8″ single-density, North Star double-density, Micropolis quad-density, Heath WH89 and Cromemco. California Pacific Computer Company, 2601 Blackburn, Davis, CA 95616.

CIRCLE 327 ON READER SERVICE CARD

UTILITIES AND MISCELLANEOUS

A Level II Basic/Disk Basic utility allows programmers to save, restore and otherwise manipulate one set of data that may be common to two or more programs. **Varkeep** is a disk-resident machine language program which adds the following commands: name save, name restore, name delete and name clear. It works with all TRS-80 disk operating systems. $19.95. Percom Data Company, 211 N. Kirby, Garland, TX 75042. (800) 527-1592.

CIRCLE 328 ON READER SERVICE CARD

TRS-80 disk files may be sorted and merged using **Sort-80,** a general purpose, machine language sort program. It requires a 32K TRS-80 Level II with two disk drives or a single drive Model II. Small Business Systems Group, Inc., 6 Carlisle Rd., Westford, MA 01886. (617) 692-3800.

CIRCLE 329 ON READER SERVICE CARD

KFS-80 is an **Indexed Sequential Access Method** for the TRS-80 which provides keyed and sequential access to multiple files, with records of up to 240 bytes. It is a Basic subroutine which is merged into the user's application program. Price for Model I is $49.95, for Model II, $79.95. Automated Resource Management, P.O. Box 4353, Irvine, CA 92716.

CIRCLE 330 ON READER SERVICE CARD

Disk-O-Tape for the Apple II and Apple II Plus enables the user to transfer an entire disk's data to cassette tape and back again. It features comprehensive error detection and a true read-after-write verification pass. $12. Dann McCreary, Box 16435-C, San Diego, CA 92116.

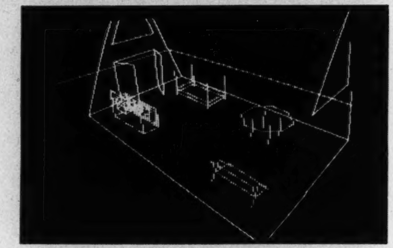
CIRCLE 331 ON READER SERVICE CARD

Disk Fixer provides experienced programmers with a complete tool kit for manipulating, repairing and protecting all data on 13 and 16 sector disks. **Monitor Extender** works with the Apple monitor and displays memory in hex, ASCII or binary. Image Computer Products, Inc., 615 Academy Dr., Northbrook, IL 60062. (312) 564-5060.

CIRCLE 332 ON READER SERVICE CARD

A-Stat 79 is a general purpose statistical package for the Apple which is designed for market research, survey analysis, social and economic modeling, simulations, teaching statistics or any application where the data bases are relatively small. It requires 32K with Applesoft on ROM or 48K and software Applesoft, plus at least one disk drive. $100. Rosen Grandon Associates, 296 Peter Green Rd., Tolland, CT 06084.

CIRCLE 333 ON READER SERVICE CARD



Sebree's Computing announces a **3-Dimensional Graphics Package** for the Atari 800. Using one of four programs, the user learns how to input any scene he wishes to view. He may then rotate and view it from any location in 3-D space. $29.95. Sebree's Computing, 456 Granite Ave., Monrovia, CA 91016. (213) 359-8092.

CIRCLE 334 ON READER SERVICE CARD

The **Statistical Package** for the TRS-80 Level II includes its own Scientific Data Management System and a battery of programs for curve fitting, probability, general statistics, distribution mathematics and test statistics. The system, also available for Apple II or Apple II Plus, requires 32K of RAM and at least one disk drive. $89.95. Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284. (714) 365-9718.

CIRCLE 335 ON READER SERVICE CARD

Almanac provides Apple users with functions related to time, the calendar and general astronomy. Functions of the programs include calendar calculations, sidereal time, sunrise and sunset calculations, calculation of phases of the moon and the dates and times of solar and lunar eclipses, a high resolution graphics model of the solar system and a software real time clock. It requires an Apple II with at least 32K RAM, Disk II and Applesoft II in ROM. $29.95. Williamsville Publishing Company, P.O. Box 250, Fredonia, NY 14063.

CIRCLE 336 ON READER SERVICE CARD

37628974
43725661
+ 13872589

Quickadd for the TRS-80 Level II enables an operator to add over 1000 eight-digit numbers through the keypad as rapidly as skill permits. During entry, no key needs to be pressed between numbers. $9.95. Omni Systems Co., P.O. Box 29347, Minneapolis, MN 55430.

CIRCLE 337 ON READER SERVICE CARD

The Maine Software Library

We rent games and utilities for the TRS-80* at a fraction of their purchase price.

For catalogue, check Reader Service. For faster service send S.A.S.E. to:

The Maine Software Library
P.O. Box 197
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*A Trade name of the Tandy Corp.

CIRCLE 206 ON READER SERVICE CARD

FILE DRAWER

File Drawer is a data base management system allowing the user complete freedom in file design, but once designed allows for very quick entry of new data.

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- **Build or change files with care**
- **look at files quickly**
- **search out a line of all records**
- **search for one line of information of all files.**
- **sort your data by each line at the same time**
- **make hard copy printouts of data**

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Rational Function Grapher
Sine and Cosine Grapher
Solids of Revolution
Limits of Sequences
Polar Graphing

Software is designed for Apple II Plus or Apple II with Applesoft firmware. Price is $15 per 32K, $25 per 48K disk system program ($8 disk/handling fee waived for orders over $50). MATH SOFTWARE, 1233 Blackthorn Place, Deerfield, IL 60015. Free catolog.

CIRCLE 209 ON READER SERVICE CARD

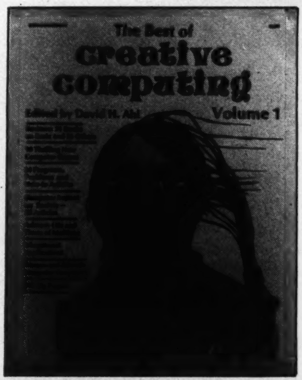
STARFIGHT...a two-player dogfight. (machine level, req. 16K) $9.95

TV TYPER...turns your Apple into a TVT. (Applesoft ROM, req. 48K) $19.95

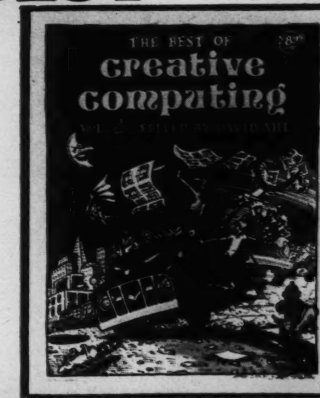
Send to: Bill Hindorff
P.O. Box 404
Glen Riddle, PA 19037

CIRCLE 254 ON READER SERVICE CARD

Now get the BEST



two smashing volumes filled with computer potpourri



Best of Creative Computing: Volume 1

All the articles, stories, learning activities and games that appeared in the first year of Creative Computing. **American Vocational Journal** says "This book is the 'Whole Earth Catolog' of computers." Contents cover the gamut of computer applications in education and recreation. Over 200 contributors! Now in its fourth print run with an exciting new cover. 328 pp. 8½ x 11" Softbound. (6A) $8.95

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To order, send a check for books plus $2.00 shipping and handling per order to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add 5% sales tax. Visa, MasterCard, and American Express orders are welcomed. For faster service, call in your bank card order toll free to 800-631-8112 (in NJ call 201-540-0445). Or use the handy order form bound into this magazine.

CIRCLE 350 ON READER SERVICE CARD

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ASSEMBLER by Gary J. Shannon. Create your own 6502 machine language programs with this easy-to-use in-RAM editor/assembler. Requires 16K or more of RAM to operate. Look at all the features you get for less than $25!

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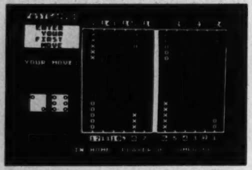
- Error checking
- Documentation includes notes on interfacing machine language to BASIC
- Price —**$24.95**

6502 DISASSEMBLER by Bob Pierce. This neat 8K BASIC program allows you to disassemble machine code and print out the disassembled listing. If you have more than 8K of memory, programs in RAM can be disassembled. Operating System ROM and the BASIC ROM can be disassembled on any size ATARI. Also works as an ASCII interpreter, translating machine code into ASCII characters. **$11.95**



FASTGAMMON™
by Bob Christiansen. The most popular backgammon-playing program for personal computers is now available for the Atari. This is the best-playing version so far, and includes the option to enter your own dice rolls. Set the display speed to your liking—play fast or slow. Beginners find it easy to learn backgammon by playing against the computer, and even very good players will find it a challenge to beat FASTGAMMON. Includes 12 pages of instructions that include the rules of the game. Written in machine language. Requires only 8K of RAM. **$19.95**

QS QUALITY SOFTWARE
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Telephone 24 hrs., 7 days a week: (213) 344-6599

WHERE TO GET IT: Ask your nearest Atari dealer to see *Quality Software's* Atari programs. Or, if you prefer, you may order directly from us. MasterCharge and Visa cardholders may telephone their orders and we will deduct $1 from orders over $19 to compensate for phone charges. Or mail your order to the address above. California residents add 6% sales tax. *Shipping Charges:* Within North America orders must include $1.50 for first class shipping and handling. Outside North America the charge for airmail shipping and handling is $5.00, payable in U.S. currency.

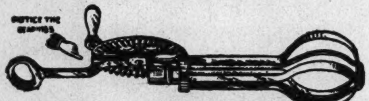
ATARI, ATARI400, and ATARI800 have been trademarked by Atari Personal Computer Systems, a Warner Communications Company.

CIRCLE 178 ON READER SERVICE CARD

UTILITIES & MISC.

Disk Keyplus is a collection of utilities that can be enabled directly from the keyboard of the TRS-80. It supports auto-repeat, lower case video, restoration of lost Basic programs, single key stroke user definable strings, Basic shorthand, direct graphic character input and typewriter style input. $19.95. SJW, Inc., P.O. Box 438, Huntingdon Valley, PA 19006. (215) 947-2057.

CIRCLE 338 ON READER SERVICE CARD



Lifeboat Associates offers **VSORT**, a high speed sort-merge system which can be used as a stand-alone utility or as an assembly language subroutine to CBasic. It requires a CP/M compatible operating system and a minimum of 32K RAM. Also available is Reclaim, a CP/M2 utility program which tests floppy and hard disk systems for error prone parts of the disk and allocates those parts to files which are "invisible" to the user. $175. Lifeboat Associates, 1651 Third Ave., New York, NY 10028.

CIRCLE 339 ON READER SERVICE CARD

Tidewater Software has announced a group of **utility packages** for the Heath H8 and H89 disk systems. Programs run in absolute binary code and are self-prompting. The company also markets a Relative Loader, a Relocatable Debug, a Disassembler with disk output and an ACM Library containing 17 subroutines. Prices range from $15 to $25. Tidewater Software Inc., P.O. Box 4465, Virginia Beach, VA 23454.

CIRCLE 340 ON READER SERVICE CARD

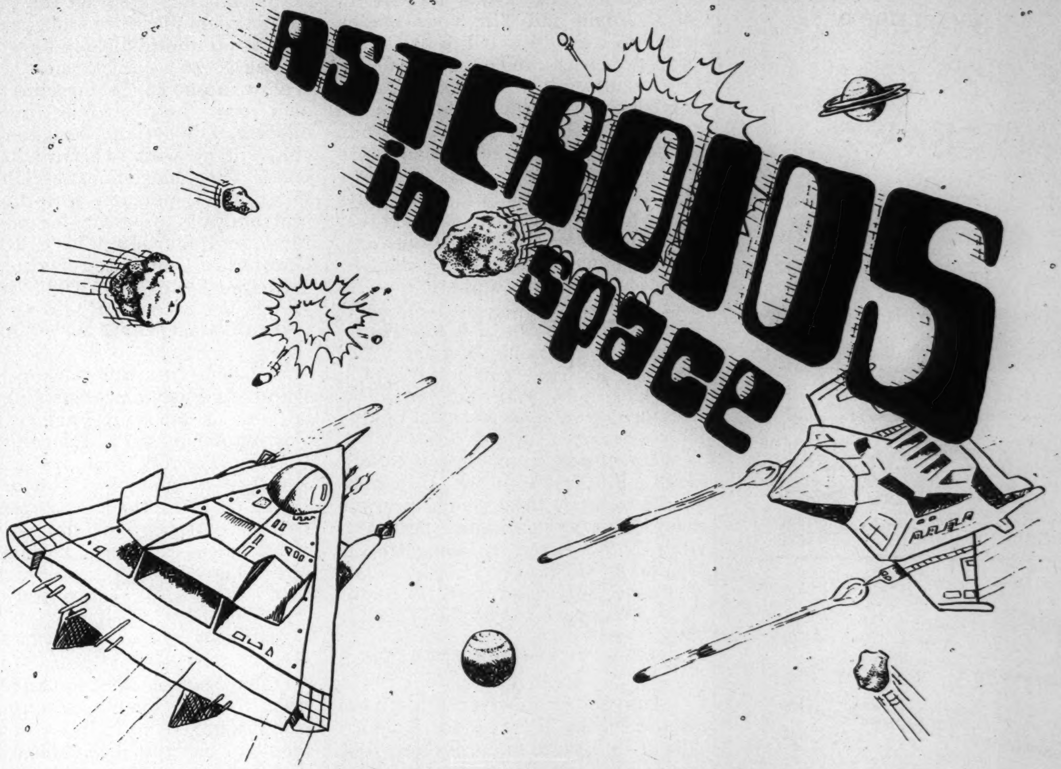
CLFIXand **TCOPY** are designed to eliminate cassette loading problems for TRS-80 users. Once loaded, CLFIX stays in memory with other Basic programs giving three new Basic commands: save, load, load? TCOPY is a program which is insensitive to volume level and allows System or Basic tapes to be duplicated. Both programs are available on one cassette for $14.95. Emmanuel B. Garcia, Jr. & Associates, 203 N. Wabash, Rm. 2102, Chicago, IL 60601. (312) 782-9750.

CIRCLE 341 ON READER SERVICE CARD

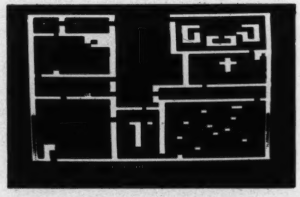
Suprdump is an interactive disk/modify utility for the TRS-80. It is designed to expedite the debugging of programs utilizing disk files and to create disk file test data. $29.95. Definitive Micro systems, 20 Glenwood Cres., St. Albert, Alberta, Canada T8N 1X5.

CIRCLE 342 ON READER SERVICE CARD

Exciting, entertaining software for the Apple II and Apple II Plus*

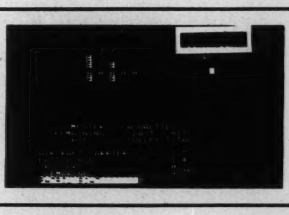


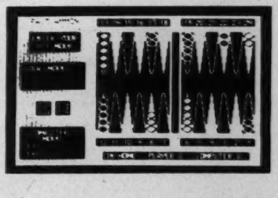
If you liked "Invaders", you'll love ASTEROIDS IN SPACE by Bruce Wallace. Your space ship is traveling in the middle of a shower of asteroids. Blast the asteroids with lasers, but beware — big asteroids fragment into small asteroids! The Apple game paddles allow you to rotate your space ship, fire its laser gun, and give it thrust to propel it through endless space. From time to time you will encounter an alien space ship whose mission is to destroy you, so you'd better destroy it first! High resolution graphics and sound effects add to the arcade-like excitement that this program generates. Runs on any Apple II with at least 32K and one disk drive. On diskette — **$19.95**



FRACAS™ by Stuart Smith. A fantastic adventure game like no other — up to eight players can participate in FRACAS at the same time. Journey in the land of FAROPH, searching for hidden treasure while warding off all sorts of unfriendly and dangerous creatures like the Ten Foot Spider and the Headless Horseman. You and your friends can compete with each other or you can join forces and gang up on the monsters. Your location is presented graphically and sound effects enliven the battles. Save your adventure on diskette or cassette and continue it at some other time. Requires at least 32K of RAM. Cassette: **$19.95** Diskette: **$24.95**

BATTLESHIP COMMANDER™ by Erik Kilk and Matthew Jew. A game of strategy. You and the computer each start out by positioning five ships of different sizes on a ten by ten grid. Then the shooting starts. Place your volleys skillfully — a combination of logic and luck are required to beat the computer. Cartoons show the ships sinking and announce the winner. Sound effects and flashing lights also add to the enjoyment of the game. Requires at least 32K of RAM. Cassette: **$14.95** Diskette: **$19.95**





FASTGAMMON™ by Bob Christiansen. Sound, hi res color, and cartoons have helped maked this the most popular backgammon-playing game for the Apple II. But don't let these entertaining features fool you — FASTGAMMON plays serious backgammon. Requires at least 24K of RAM. Cassette: **$19.95** Diskette: **$24.95**

QUALITY SOFTWARE

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WHERE TO GET IT: Call us at (213) 344-6599 for the name of the Quality Software dealer nearest you. If necessary, you may order directly from us. MasterCharge and Visa cardholders may place orders by telephone and we will deduct $1 from orders over $19 to compensate for phone charges. Or mail your order to the address above. California residents add 6% sales tax. SHIPPING CHARGES: Within North America orders must include $1.50 for first class shipping and handling. Outside North America the charge for airmail shipping and handling is $5.00 — payable in U.S. currency.

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BUSINESS

The **Project Boss** for the TI 99/4, Apple and TRS-80 is a disk based system designed to assist the project manager of construction jobs or consultants managing engineering or architectural engagements in the financial management of individual projects. A **Business Data Base System** for the TRS-80 allows the user to define and build data bases for such purposes as inventory control, general ledger accounting, accounts payable and accounts receivable. It is compatible with TRSDOS, NEWDOS and 3.0 DOS. $89.95. Charles Mann & Associates, Consumer Products Division, 7594 Sam Remo Trail, Yucca Valley, CA 92284. (714) 365-9718.

CIRCLE 343 ON READER SERVICE CARD

Datebook from Organic Software maintains a record of appointments for up to three people (or three rooms) for an unlimited period of time. It is written in Pascal and is available to run on CP/M. $295. Organic Software, 1492 Windsor Way, Livermore, CA 94550. (425) 455-4034.

CIRCLE 344 ON READER SERVICE CARD

Inv-M2 is an inventory control system for the TRS-80 Model II which allows the user to maintain over 7000 records on a formatted disk used exclusively for data. It is on-line, interactive, menu-driven and human engineered. $149. A simplified version for the Model I is available for $99. Micro Architect, Inc., 96 Dothan St., Arlington, MA 02174. (617) 643-4713.

CIRCLE 345 ON READER SERVICE CARD

Data Manager, a program for Apple disk systems, is a data base management system and mailing list which stores up to 96,000 alphanumeric characters per disk and retrieves data from up to 32,000 characters at a time. It features half-second recovery, a cursor-based editor and sorts on any key. $49.95. Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662. (201) 843-0550.

CIRCLE 346 ON READER SERVICE CARD

MicroLedger from Compumax is now available for the Atari 800 with 24K memory, single disk drive and printer. The program produces trial balances, profit and loss statements and balance sheets. Basic source code is included. $140. Compumax, Inc., P.O. Box 1139, Palo Alto, CA 94301.

CIRCLE 347 ON READER SERVICE CARD

The **Ultimail Version 5** List Management System for the TRS-80 uses random disk files and stores 650 records on a mini-disk or 1000 on an 8" disk. Each record consists of a zip code, an alpha key for directory printouts, and three or four lines per address. The system, designed for a 48K TRS-80 with two mini-disks or one 8" disk, consists of the Ultimail program, a machine sort program and a utility program for printing three and four up labels. $124.95. Computer Generated Data, 5541 Parliament Dr., Suite 208, Virginia Beach, VA 23462. (804) 497-1165.

CIRCLE 348 ON READER SERVICE CARD

A **Job Costing** package from Arkansas Systems consists of three systems: a Reporting Facility, a Job Costing Accounts Payable, and a Job Costing Payroll. The systems are designed to run on a Z-80 or 8080 processor using the CP/M operating system and hard or floppy disks. $700. Micro Software Department, Arkansas Systems, Inc., Suite 206, 8901 Kanis Rd., Little Rock, AR 72205. (501) 227-8471.

CIRCLE 349 ON READER SERVICE CARD

The **Master Accountant Business System** for CP/M-compatible computer systems includes accounts payable, accounts receivable, payroll and general ledger programs. All software is written in Microsoft Disk Basic and is available on 8" diskettes. $100. Computer Services, P.O. Box 2292, Hickory, NC 28601. (704) 294-1616.

CIRCLE 351 ON READER SERVICE CARD

The **Micro Writer** is a report writing utility which enables users of Smoke Signal Broadcasting Systems hardware to catalog report formats and specifications. The system is written in 6800 assembler and runs under DOS68 version 5.1. $249. Ripley Computers, 126 North Main St., Souderton, PA 18964. (215) 723-1509.

CIRCLE 352 ON READER SERVICE CARD

The **NWA Statpak** is a multi-function statistics library for users of microcomputers with CP/M and MBasic. The package contains files utilities programs which allow the user to create, edit and merge data files and select scale data within files. The computational section includes programs for probability calculations, single variable statistics, regression analysis, etc. Northwest Analytic, Inc., P.O. Box 14430, Portland, OR 97214. (503) 238-9760.

CIRCLE 353 ON READER SERVICE CARD

AIR TRAFFIC CONTROLLER

In **Air Traffic Controller** you assume responsibility for the safe flow of air traffic within a 15x25 mile area up to 5,000 feet in altitude. During your shift as a controller in charge of this airspace, 26 aircraft become active and under your control. Jets and prop planes have to be guided to and from the two airports, navigational beacons and ten entry/exit fixes. The aircraft enter the controller's airspace at various altitudes and headings whether or not you are ready.

Air Traffic Controller retains the basic realism of air traffic control. This program requires the same steady nerves under pressure and the same instant, almost instinctive, analyses of complex emergencies which are demanded of a professional air traffic controller. But "ATC" adds the excitement and well-defined goals of a game. This is just a simulation, and all passengers left in air traffic limbo by a panicked player will live to fly another day.

Your goal is to get all of the aircraft to their assigned destination before the shift is completed. At your disposal are a radar display of the aircraft positions in the control area; coded information concerning aircraft heading, destination and fuel supply; navaids enabling you to hold aircraft or assign them automatic approaches; and commands to alter the altitude and heading of the aircraft. Working against you are altitude and heading requirements, fuel restrictions and, of course, the inimitable clock.

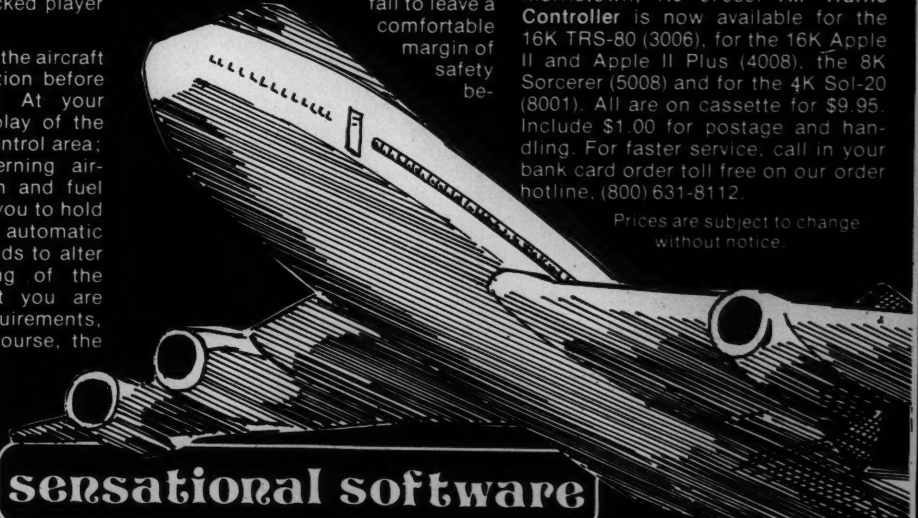
The most obvious measure of difficulty of a game is the clock setting at the beginning. In a 99 minute game you will have time to go fix a sandwich between the appearance of two successive aircraft, while in the 16 minute game you may not have time to swallow before all of the aircraft have appeared.

No two games, even at the same clock setting, are ever alike. As controller, you must cope with the unique requirements of each aircraft. The game will end if you commit a "boundry error," that is, if an aircraft fails to leave your area at the proper altitude and exit fix...causing an unpleasant surprise for the controller next door. The game also ends if you fail to leave a comfortable margin of safety between the aircraft as they whiz past each other. In cases of excessive delay, fuel supply considerations will become invested with a particular sense of urgency.

Successful guidance of all aircraft to their destination is a heady accomplishment. This never fails to thrill ATC enthusiasts at each successive level of play.

Your local retail store should carry Creative Computing Software. If your favorite retailer does not carry the software you need, have him call in your order to (800) 631-8112. Or you can order directly from Creative Computing. Write to Creative Computing Software, P.O. Box 789-M, Morristown, NJ 07960. **Air Traffic Controller** is now available for the 16K TRS-80 (3006), for the 16K Apple II and Apple II Plus (4008), the 8K Sorcerer (5008) and for the 4K Sol-20 (8001). All are on cassette for $9.95. Include $1.00 for postage and handling. For faster service, call in your bank card order toll free on our order hotline, (800) 631-8112.

Prices are subject to change without notice.



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INTRODUCING
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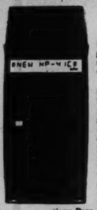
A CALCULATOR. A SYSTEM.
A WHOLE NEW STANDARD.

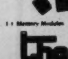


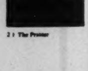
The new HP-41C from Hewlett-Packard is a powerful programmable calculator that features: an LCD display with alphanumeric capability; 63 registers of data storage or up to 400 lines of program memory—expandable to 319 registers or up to 2,000 program lines; up to 6 levels of subroutines; 10 conditionals and 56 internal flags; specific loop control; indirect addressing; local and global branching; Continuous Memory; RPN logic.

And when you need them: Memory Modules—plug-in modules for storing programs and data; an "extra smart" Card Reader; a Printer that prints upper and lower case alpha plus special characters and does high resolution plotting; the Wand to input programs in bar code form (available early 1980); Application Modules—preprogrammed, plug-in modules that give solutions to a wide range of problems.

The HP-41C lets you reassign any standard function, any programs you've written, or programs provided in the Application Modules—to any keyboard location you want. And of course Hewlett-Packard backs the HP-41C with total software support including an Owner's Manual and thousands of programs in the HP-41C Applications Pacs, Solutions Books, and the HP Users' Library.

Experience this remarkable instrument. The new HP-41C from Hewlett-Packard. A calculator. A system. A whole new standard.


1 Memory Modules


2 The Printer

the computer corner
White Plains Mall, 200 Hamilton Ave.
White Plains, N.Y. 10601
(914)WHY-DATA.

CIRCLE 126 ON READER SERVICE CARD

BUSINESS

CDS Corporation announces **Mail List** for the Commodore CBM 16K and 32K computers with CBM 2040 disk drives and CBM or ASCII printers. Program features include storage of 1050 records per disk, user-adjustable field length, label printing by zip code or alphabet and a 30-page manual. $95. CDS Corporation, 695 East Tenth North, Logan, UT. (801) 753-6990.

CIRCLE 354 ON READER SERVICE CARD

A **Master Catalog** system that can keep track of all the files on all diskettes in use is available on single-density diskettes for CP/M users. It produces a listing of file names in alphabetical order with the name of the disk containing that file. $10. Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367.

CIRCLE 355 ON READER SERVICE CARD

PROFESSIONAL

Comp-U-Sky is a high resolution graphics program which enables the Apple user to locate, identify and provide information on stellar objects. It presents graphic displays for eight directions, as well as overhead, for any location on earth. $39.95 on disk. Scharf Software, P.O. Box 18445, Irvine, CA 92713.

CIRCLE 356 ON READER SERVICE CARD

Bluebird's Company introduces **Max/Min-It**, which is a linear programming software package with documentation that steps through the how-to of setting up the problem with hints on what to look for in defining variables, constraints, and functions. Detailed examples are provided. The program is designed to run on the TRS-80 Level II 16K or minimum 32K disk system. $29.95. Bluebird's Company, 2267 23rd St., Wyandotte, MI 48192. (313) 285-4455.

CIRCLE 357 ON READER SERVICE CARD

Church Donations for the Level II TRS-80 with two disk drives and a line printer is designed to record the donations for up to 1000 parishioners in four different user selectable categories. Reports include: total donations to date by category, quarterly reports to the donors and summary of donations for each collection. $125. Custom Data, P.O. Box 1066, Alamogordo, NM 88310.

CIRCLE 358 ON READER SERVICE CARD

Plotter is said to turn any microcomputer that operates under CP/M and uses CBasic into a graphics output station. Output, which may be directed to the console terminal or the printer, consists of an X and Y axis plot of coordinate pairs. $35. HSC Computer Services, Ltd., P.O. Box 43, Brooklyn, NY 11236. (212) 780-0022.

CIRCLE 359 ON READER SERVICE CARD

SYSTEMS SOFTWARE

LANGUAGES

Lisp, a programming language designed for artificial intelligence applications, is now available for Cromemco Z-80 based computer systems. It is available on 5" or 8" floppy disk with complete documentation. Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043. (415) 964-7400.

CIRCLE 360 ON READER SERVICE CARD

SYSTEMS

Digital Research has introduced **CP/NET,** an operating system for microcomputer networks. It is designed for OEM and end-user adaptation to a wide variety of network hardware, and operates with CP/M and MP/M to support CP/M compatible software. Digital Research, Inc., P.O. Box 579, Pacific Grove, CA 93950. (408) 649-3896.

CIRCLE 361 ON READER SERVICE CARD

The Apple **Assembly Language Development System** is an assembler/editor/formatter which includes a cursor-based editor, global and local labels and disk-based macros which allow incorporation of frequently used subroutines into any program. $39.95. Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662. (201) 843-0550.

CIRCLE 362 ON READER SERVICE CARD

EZ-Coder is a Basic Precompiler for Northstar systems which features self-documenting Basic and complete cross-referencing of all variables, labels user defined functions. $79. Demerco Industries, P.O. Box 2396, Van Nuys, CA 91404.

CIRCLE 363 ON READER SERVICE CARD

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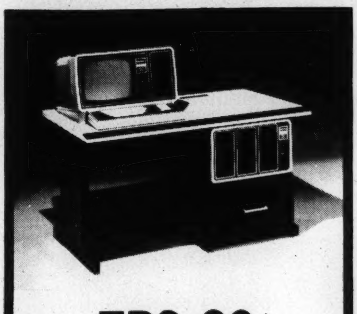

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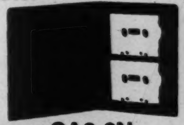

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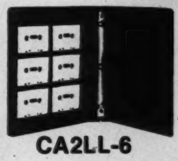

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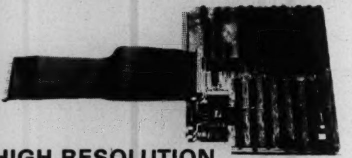
SYSTEMS SOFTWARE

Development Pac Extension is a co-resident machine language system that loads on top of the Exidy Z-80 Development Pac and extends the ROM-based assembler-editor with 18 additional commands. In addition to editor and file commands, it includes a built-in RS-232 print driver, the ability to halt and resume assembler listings and single command jumps among the DDT80, Editor or Monitor subsystems. $29.95. Quality Software, 6660 Reseda Blvd., Suite 103, Reseda, CA 91335.

CIRCLE 364 ON READER SERVICE CARD

MUSIC & GRAPHICS



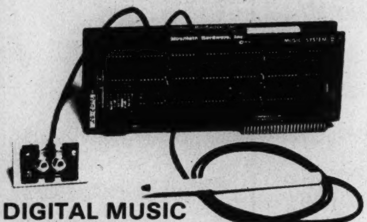
HIGH RESOLUTION GRAPHICS FOR PET

A high resolution graphic display board for new or old Commodore PET computers that provides video mixing and ROM sockets is introduced by Micro Technology Unlimited.

The MTU K-1008-6 PET Graphic Interface adds high resolution graphics to Commodore PET computers. Providing software selectable PET video, graphic video, or both, the expansion board features five ROM sockets that can be set at the same or different addresses with software control of which sockets are enabled. $320.

Micro Technology Unlimited, 2806 Hillsborough St., P.O. Box 12106, Raleigh, NC 27605. (919) 833-1458.

CIRCLE 365 ON READER SERVICE CARD



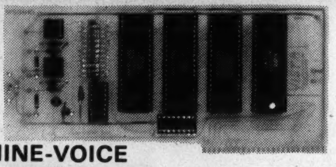
DIGITAL MUSIC FOR APPLE

Mountain Computer Inc. announces MusicSystem for Apple II computers. This 16-voice digital synthesizer permits the creation of the sounds of real musical instruments utilizing the principle of additive synthesis. The generation of sounds is accomplished through fully programmable waveforms, envelopes, and amplitudes for each musical voice.

Provided with the hardware system is software for editing and playing of musical compositions. The Editor program permits graphic input of sheet music utilizing standard music notation. The Player program permits polyphonic performance of musical compositions. Stereo output is to user's stereo amplifier and speakers, or directly off card with stereo headphones.

Mountain Computer Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060. (408) 429-8600.

CIRCLE 366 ON READER SERVICE CARD



NINE-VOICE MUSIC BOARD

Vista Media Products announces the Music Machine Nine. Using the latest state-of-the-art LSI technology, the Music Machine Nine can produce nine voices.

The board uses three AY3-8910's and requires only one slot. It can use software now available to produce and play back nine voice music compatible with other music boards. It will respond to commands for pitch, amplitude, duration, attack, delay, etc. It is completely compatible with the Apple II bus structure.

Advanced Computer Products, 1310 E. Edinger, Santa Ana, CA 92705. (714) 558-8813.

CIRCLE 367 ON READER SERVICE CARD

PASCAL GRAPHICS COMPUTER SYSTEM

Integrated Research and Information Systems Corporation announces the Ensemble I20GX, a self-contained computer system.

Standard versions are based upon the Western Digital Pascal MicroEngine, high resolution graphics, a 15" monitor, 12-slot S-100 standard motherboard, detachable keyboard, double density, double-sized dual floppy disk subsystem, Z80 alternate on-board MPU, memory parity, 128KB dynamic RAM, UCSD Pascal, CP/M, constant voltage

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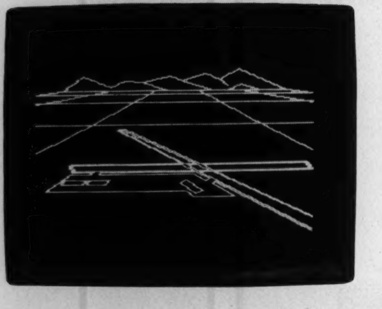
Animation for the Apple II



With SubLOGIC's A2-3D1 high-speed animation package for your Apple, you can • generate scenes or drawings • view them from any distance or angle and, yes • even rotate them. All you need is 16K RAM and the creative urge.

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the correspondent
By Roger Wagner

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transformer, and printer port for graphics hard copy output. $9796.

The Ensemble I20GX in its standard configuration runs under UCSD Pascal and CP/M.

A low-cost version of the Ensemble I20GX uses the Z80 MPU, a 9″ black and white monitor, and one 5.25″ floppy disk drive. Packaging includes a 12-slot motherboard, CVT power supply, and built-in expansion for two more 5.25″ drives. $3464.

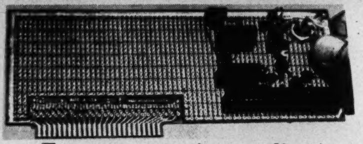
Integrated Research and Information Systems, 10150 Sorrento Valley Rd., Suite 320, San Diego, CA 92121. (714) 457-3730.

CIRCLE 368 ON READER SERVICE CARD

VIDEOTAPE APPLE COLOR GRAPHICS

Adwar Video offers two interfaces for bridging the difference between Apple computer graphics output standards and those of NTSC video recording and broadcasting equipment.

The simpler of the two devices, the Adwar Apple Proc Mod ($800.), is a circuit board inserted into the Apple Plug-in slot #7. This brings the Apple output sufficiently close to NTSC video equipment tolerances to permit direct videotaping.



For more exacting applications, such as combining the Apple color graphics output, through a time-base corrector, with other video signals through a switcher, the more sophisticated Adwar Apple Graphics Interface is required. This device stores an entire non-standard Apple video frame in solid state memory. It then reads out from that memory at standard NTSC rates required for multi-source tape editing, special effects and telecasting on the air.

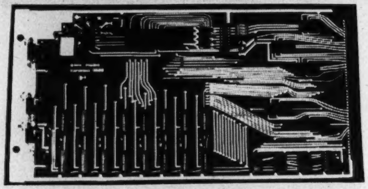
Adwar Video, 100 Fifth Ave., New York, NY 10011. (212) 691-0976.

CIRCLE 369 ON READER SERVICE CARD

COLOR GRAPHICS FOR H-8

The Heathkit H8 computer can generate high resolution color graphics with the addition of a color graphics board.

The board is fully compatible and may be put in any one of the available slots within the H8 mainframe. It also contains 8K of static read/write memory, which is address dip switch selectable. On board rf modulation is also included. Kit, $379; assembled, $479.



Owen Phairis, Computer Products, P.O. Box 3400, Big Bear Lake, CA 92315.

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MAGAZINES, NEWSLETTERS

Nibble Magazine is focused on the Apple II and Apple II Plus computers. Each issue features a central theme such as home finance, games, simulation, or data base management, and contains programs of significant size and range, together with comprehensive articles on how to use the programs and the programming methods. $15. for eight issues.

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The Dakin5 12-in-1 Utility Kit gives your programming more punch!

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COMPUTERS

COLOR COMPUTER, TRS-80 MODEL III, POCKET COMPUTER FROM RADIO SHACK

Radio Shack has announced the addition of three new models to its line of personal computers.

The TRS-80 Model III, which sells for $699 with 4K memory, is expandable to a 32K disk system $2495. The Model III also offers word processing capability, including a 50 c.p.m. letter—quality printer. $3600.

A pocket computer, designed to compete with the recently-introduced Panasonic, Quasar and Lexicon handheld unites, weights 6 oz. and measures 7" in length. $299.

Watch for feature reviews of these systems in upcoming issues of *Creative Computing.*

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MicroDaSys announces Millie, a microsystem which uses the S-100 bus, Z-80 processor, double-density 8" disk drives and the CP/M operating system.

The Data Base integration approach unites all the software for the microsystem. Included are programs for word processing, mailing list, form letter generation, order entry, inventory, accounts payable and receivable, payroll, cost accounting and general ledger.

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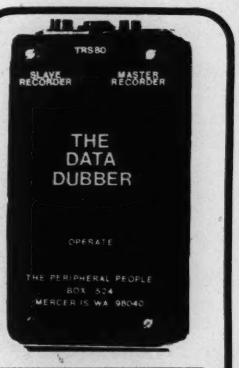

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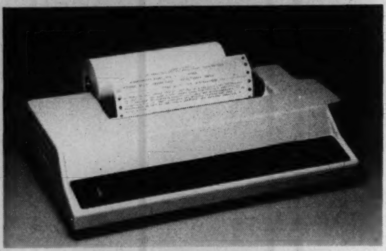

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For a free copy, send a stamped, self-addressed envelope marked "list" to, Bayshore Books, P.O. Box 848-B, Nokomis, FL 33555.

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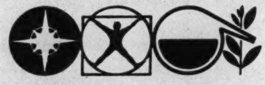

DIRECTORY OF EDUCATIONAL SOFTWARE

Dresden Associates announces *School MicroWare,* a directory of instructional microcomputer software, for pre-college instructional computer users.

The first edition will feature over 500 instructional programs and packages. TRS-80, Commodore PET, and Apple II. The main section of the directory will include four-line items for all products organized by major discipline and within that by subject area.

The first issue is scheduled for late September, 1980. Quarterly updates will be published in December, February, and April. A regular subscription will be $20 per volume, including the current directory and three updates.

Dresden Associates, P.O. Box 246, Dresden, ME 04342.

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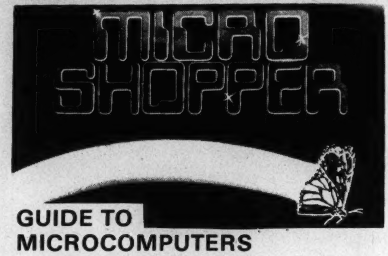

GUIDE TO MICROCOMPUTERS

The 1980 edition of *MicroShopper 80: The New Computers,* a 192-page business and personal guide to microcomputer hardware and software, has been announced by P.G.I. Publishing.

Published in a standard 9" x 12" book format, the fifth edition of MicroShopper features 150 detailed photographs of microcomputer systems, peripherals and accessories, including industry literature, from more than 100 manufacturers representing over 500 products. $9.95.

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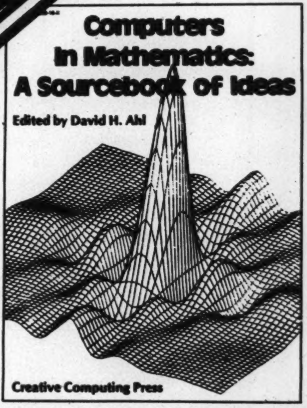
Computers in Mathematics: A Sourcebook of Ideas
Edited by David H. Ahl
Creative Computing Press

Computers in Mathematics: A Sourcebook of Ideas

Here is a huge sourcebook of ideas for using computers in mathematics instruction. There are sections on:
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Pragmatic, ready to use, classroom tested ideas are presented for everything from the most basic introduction to binary numbers to advanced techniques like multiple regression analysis and differential equations. Every item discussed has a complete explanation including flowcharts, programs, and sample runs.

The book includes many activities that don't require a computer. And if you're considering expanding your computer facilities you'll find a section on how to select a computer complete with an invaluable microcomputer comparison chart.

Although much of the material has appeared in Creative Computing, many of those back issues are no longer available. Consequently this book meets the demand of making available that popular information.

Edited by David Ahl. Large format paperbound, 224 pages, $15.95. (12D)

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Reviews

Steve Gray, et al

Getting down to BUSINESS with your MICROCOMPUTER, by James A. Gupton, Jr. Sourcebooks, 18758 Bryant St., Northridge, CA 91324. 254 pages, paperback $9.95. 1979.

The title is misleading, because this is not a book about how to use a small computer in business. Instead, it "explains what a microcomputer is, how it functions, and its many uses," as the back cover puts it.

On that basis, it succeeds pretty well, with a down-to-earth text that tells a little about what a microcomputer is, and a lot about what's on the market (or was at the time of writing).

Gupton puts a lot of emphasis on three computers: the Radio Shack TRS-80, Heathkit H8 and H11, and the Altair 8800b. Each gets a chapter, and the chapter on "how to build your own" is about building the Heathkit computers.

Other chapters are on the basics, peripherals, mass data storage peripherals, home applications, seven other systems (Apple, Cromemco, Ohio Scientific, Southwest, etc.), control applications, business applications and, finally, a seven-page chapter on "selecting a microcomputer system for your business." This last tells what would be in a system in various price ranges, and ends with a single page on "how to select a system."

The book is half illustrations, the majority from Radio Shack, Heath, and MITS/Pertec. They help give an idea of what it's all about, although they sometimes seem used to fill space.

Some readers would undoubtedly prefer more on "how to select a system," and less photos of computers and block diagrams of microprocessors, but this book is certainly better than the little mass-market paperbacks.

* * *

Computer Graphics Primer, by Mitchell Waite. Howard W. Sams & Co., Inc., Indianapolis, IN. 184 pages, paperback $12.95. 1979. (Available from Creative Computing Book Service.)

The back cover says "this book shows you how to create your own video graphics on the new personal computers . . . It is oriented toward the Radio Shack TRS-80, the Commodore PET 2001, and the Apple II home computers." However, it's almost entirely about the Apple II when it comes to showing how to create graphics.

The book's high price is due in part to the 20 color photos of various graphics displays, and to the yellow overlays used on the 30 Apple II graphics programs.

After some nifty photos and an introduction to what can be done in graphics, Waite gets into the intricacies of stroke and raster-scan graphics, memory mapping, character generators, video generators, and then presents a catalog of 11 "low-cost graphics computers" such as the Apple II, Sorcerer, and TRS-80, and of five "high-cost graphics computers," including the HP 2648, Tektronix 4051, and Chromatics CG series.

Peripherals such as plotters and printers are discussed next, followed by an entire chapter of 74 pages on Graphics Programming, showing how, with complete programs, (highlighted with yellow overlays), to draw lines, curves, rectangles, polygons, gaming figures (birds, tie fighters), mandalas, and several examples of "graphics art with shape tables."

The chapter ends with three detailed and very instructive sections, on writing Pong games in Basic, detailed drawing and digitizing tables, and moving-figure animation.

Although expensive, this book is recommended for the beginner who wants to get into computer graphics and doesn't know where to start. But if you already have a computer and it's not an Apple II, this book may only make you drool, unless you happen to have a Chromatics or Intecolor computer.

* * *

Interactive Computer Graphics in Science Teaching, edited by John McKenzie, L.R.B. Elton, & R. Lewis. Ellis Horwood Ltd., Chichester, Sussex, England; Halsted Press, div. of John Wiley & Sons, New York. 248 pages, hardcover $25.00. 1979.

This book, intended for teachers of undergraduate science, "records the substantial experience of a computer-assisted learning (CAL) project, sponsored by the National Development Programme, whilst the Group (originally from University College, Chelsea College, London, and the University of Surrey) was still bound together in a working collaboration," according to the inside front cover.

The text covers hardware (graphical displays, computers, software) and subject-specific material for physics, chemistry, and biology teaching packages; educational technology of design, evaluation and transfer; and costing and trends.

The three dozen CUSC (Computers in the Undergraduate Science Curriculum) teaching packages that are discussed are available from Chelsea College in London.

The book is full of screen photos showing plots such as "successful solution to the wave equation for an eigenvalue of 42.1 eV," "electron density for a bonding orbital in HF(C15:MLORB4)," and "cardiac output determination (BM1:DYE)," picking one from each of the three disciplines involved.

Because these packages are designed for a UK curriculum, their main interest to science teachers in this country may be in showing how such software is used in another country.

* * *

Programming the Z80, by Rodnay Zaks. Sybex Inc., 2020 Milvia St., Berkeley, CA 94704. 626 pages, paperback $14.95. 1979.

This is one of the more detailed books on Z80 programming, and has a very good, detailed (60-page) chapter on Basic Programming Techniques, which follows chapters on Basic Concepts and on Z80 Hardware Organization.

The chapter on programming techniques provides a very careful introduction to the use of several instructions described in the previous chapter, starting with short programs on 8-bit addition and 16-bit addition, then adding new instructions and working up to more complex programs such as multiplication and division, meanwhile introducing concepts such as register management, loops, and subroutines.

The longest chapter in the book, 284 pages on The Z80 Instruction Set, provides as detailed information on each instruction as possible within a book of this scope.

The remaining chapters are on Addressing Techniques, Input/Output Techniques, Input/Output Devices, Application Examples (code conversion, checksum computation, bubble sort, etc.), Data Structures, and Program Development. These are all written with great attention to detail, providing a vast amount of information to the reader who is interested enough in Z80 programming to plow through all 600-plus pages.

One of the few drawbacks is that some of the drawings are poorly done, or use lettering too small to read comfortably, or both. These are minor objections in a book whose author has taken great pains to provide a readable and highly instructive text in a subject that is inherently dull to most readers.

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* * *

6502 Software Gourmet Guide & Cookbook, by Robert Findley. Scelbi Publications, 20 Hurlbut St., Elmwood, CT 06110. 204 pages, paperback $10.95. 1979.

Why is it called a cookbook? The back cover asks, and then answers, "Because it's a book of recipes. It contains routines, subroutines and short programs. These are the ingredients. All you do is take a pinch of this, a pinch of that. Combine the ingredients, and voila — your own masterpiece! Just the program to suit your taste."

After two introductory chapters on the 6502 instruction set and programming techniques, the book has four chapters on routines: for general purposes (clearing a section of memory, multiple precision, time delays, random numbers, etc.), conversion (ASCII to/from Baudot, decimal to binary, binary to decimal), floating point (add, subtract, multiply, divide, input, output), and decimal arithmetic (the four functions).

The chapter on Input/Output Processing (lighting LEDs, generating serial data, handshaking, interrupts, etc.), is followed by a last chapter on Search and Sort Routines (fixed-format tables, free-format search, ripple sort).

If the 6502 programs you want to concoct can be whipped up from the contents of this book, which is written very clearly, you may find it of use. But the introductory material is of necessity rather short in a book of only 200 pages, so this would be more useful to a person already familiar with programming than to a novice.

* * *

PIMS: Personal Information Management System, by Madan L. Gupta. Scelbi Publications, Box 133 PP STN, Milford, CT 06460. 87 pages, paperback $9.95. 1979.

"Improve your life style," says the front cover of this book, just below the photo of a handsome young couple, in a come-on that sounds more like an ad for a car or boat.

However, the cover soon dispels the consumer-goods-ad look with "Learn how you can unleash the power of a personal computer for your own benefit. A ready-to-use data base management program."

Improve your life style with a DBMS? The author insists you can accomplish more in less time with a computer, by doing things you ordinarily "skip doing because it's too much bother." Things like balancing your checkbook, and maintaining lists of department-store charges, household valuables, tax-deductible expenses, and mailing addresses.

"Tasks such as these take a significant portion of any person's time," says Gupta. "A better organized individual is a more efficient individual. If you have a convenient way of doing these tasks rapidly you could get more things accomplished in your life."

Two chapters describe what a computer can do for you, two more deal with information management and how to use PIMS, and a very long chapter presents 15 typical applications, including recipes, mailing lists, accounts receivable, sales analysis, etc.

The last chapter tells how to load PIMS into your computer and includes the DBMS program, seven pages long, about 360 lines of Microsoft Basic. The program was tested on a Level II 16K TRS-80 and a 16K PET 2001, and should run on almost any system using Microsoft Basic.

The book could have been made two inches narrower by eliminating the several dozen key phrases in the margins. But then again, they help make this a fairly painless introduction to a DBMS, aimed at "the computer novice with no previous experience," as the promo sheet puts it.

It is hoped the novice will soon discover that some data is much easier to store on 3-by-5 file cards, including recipes, inventory of household valuables, maintenance records, etc. Unless he enjoys loading program tapes and data tapes for rather trivial uses of a computer.

⁂

Beating the Races with a Computer, by Steven L. Brecher. Distributed by BITS Inc., Box 428, 25 Route 101 West, Peterborough, NH 03458. 100 pages, paperback $14.95. 1980.

It should first be noted that this book contains no program. The author told me he's "cautious about supplying what the public may see as a turnkey system to making a fortune." The last sentence in his book says "no one is going to get rich quick."

Nevertheless, he did say that "if there is interest among the readers in obtaining the program," he may provide it. But he noted that "there's an order of magnitude of difference in supporting a fairly large and complex software product."

"The program was much too long to put in the book, so this is a sourcebook of ideas," said Brecher. The program, he said, was written in Fortran for a Data General 200, and the database was run on an NCSS time-sharing system.

The tone of the book is set by the title of Chapter 2, "Horse Racing is a Stochastic Process." In other words, you'd better know what that means, as well as understand Multiple Regression (the title of Chapter 4), Data Weighing and Normalization (Ch 6), and generating model equations (Ch 7).

Appendix A is an annotated bibliography, B is on regression coefficients and statistics, and C is a database description, which includes several dozen items for "each starter in each sample race," and several dozen more for "race data."

This is a book for those few computer experts who bet the races, experts who can appreciate one of the concluding sentences: "Simulated wagering on the sample races yielded profits of from 5% to 25% per unit bet, depending on the degree of sophistication and selectivity of the wagering strategy."

⁂

Creative Growth Games, by Eugene Raudsepp with George P. Hough, Jr., Harcourt, Brace, Jovanovitch, New York, NY. 195 pages, paperback $3.95.

This is not just another collection of familiar old games. Raudsepp, President of Princeton Creative Research, Inc., and Hough, a journalist, have assembled an exercise manual for the mind. The introduction discusses creativity, stressing the need for creative thinking in a world of rapid change. In the words of the authors, the book is designed to: "1. Revitalize, develop, and strengthen in you all the important components of attributes of creative behavior and innovative problem solving, and 2. Give you repeated insights into the kinds of difficulties you face as a problem solver, and how they can be overcome."

Does it fulfill these promises? That depends on how you use the book. The exercises, which range from word games to story writing, are not meant for casual browsing. Each is designed to develop a specific aspect of creativity; looking at things in a new way, turning a problem around, lateral thinking, etc. One problem asks you to find hidden words, another asks for suggested captions for a cartoon. While browsing is entertaining, it will not lead to any increase in your creativity. But, if tackled in the suggested manner, the book can show you new ways to think, and new methods for dealing with problems.

A brief conclusion gives guideposts for creativity, both in specific areas such as problem solving, and in general areas such as lifestyles. If you ever find yourself stuck for a solution, or lost for words, this book might be of help. At worst, it will provide a few hours diversion.

—DL

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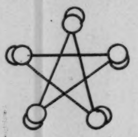
Puzzle Answers

Pyramid Power: First move: Invert pyramids 2 and 3. Second move: Invert pyramids 3 and 4. Third move: Invert pyramids 4 and 5.

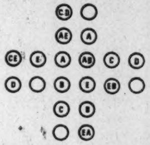
Money Talks: Form a star with two coins at each point.



A Cigar Puzzle: Six cigars. He first makes 5 cigars out of the original 25 butts. After smoking these 5 cigars he will have 5 more cigar butts which he can now make into a sixth cigar.

The Perfect Score: You can score 100 by using six arrows: 16, 16, 17, 17, 17, 17.

The Square Puzzle: You will find 19 different squares indicated in the drawing below. There are 9 squares of the four *A's* type, four squares of the *B's* type, four squares of the *C's* type and two squares of the *D's* type.



To render the cross "squareless," remove the circles marked "E." It will then be impossible to form any of the above squares.

The Choo Choo Puzzle: The answer is 75 miles per hour. After running two fifths of the tunnel, one of the boys and the front of the train are at one end (since he *just* makes it out). Since both boys run at the same speed, the other boy has also run two fifths of the tunnel. At this point he has another fifth to go. In the time it takes him to run the last fifth the train covers the entire tunnel (five fifths). He exits the tunnel *just* as the train does. Since the train covered five fifths as he covered one fifth, the train is going five times as fast. 5 x 5 = 75.

A Groovy Problem: One spiral groove.

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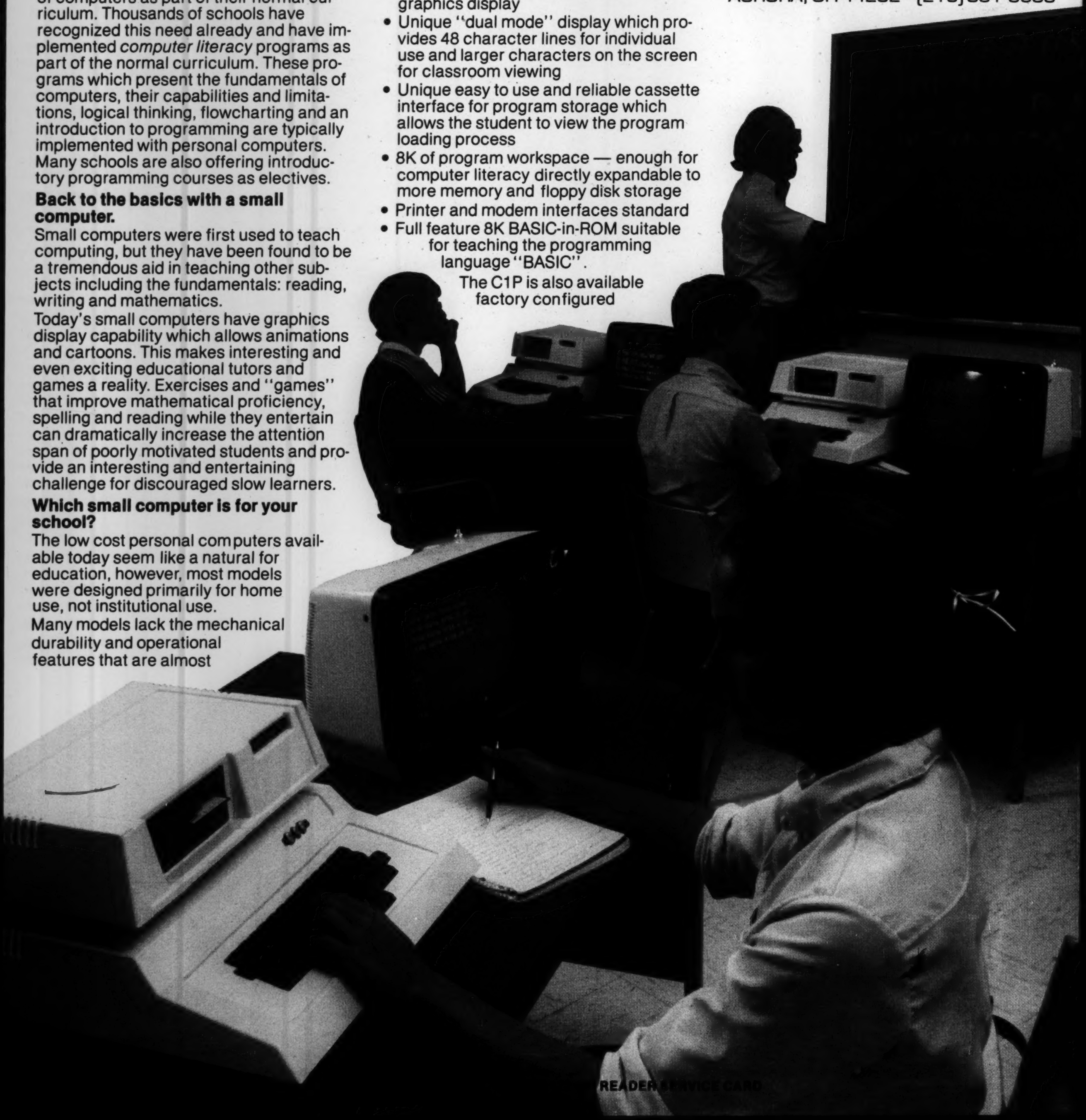

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